

NLED 4 Channel DMX Wash Controller v.1a with 3-Digit LED Display

This DMX connected LED controller from Northern Lights Electronic Design, is designed for DIY LED wash/flood light construction. With numerous features including 8-bit and 16-bit DMX reception modes, serial reception mode, stand-alone sequences, and an external 3-digit LED display for adjusting the configurations and options. No more reading and setting DIP switches, the configurations such as DMX address and reception modes can be adjusted easily. Serial reception allows many other TTL serial devices, such as Arduino, FTDI adapters, and wireless XBees to control the device. And for when a data signal is not available or required, there are several stand-alone sequences that the device can run, with the option to upload customized sequences through specialized software. With four, high current sinking outputs, many different LED configurations can be utilized, such as LED strip, high wattage LEDs, or LED arrays. RGB+W or RGB+U.V. or any combination of single color LEDs can be utilized.

Features:

- Small Size 2.1" x 1.75" x 0.5"(tall)
 - 4 Output Channels, Current Sinking, for RGB+W or RGB+U.V. or single color setups.
 - High Current Sink Outputs(LED Configuration as Common Anode, see pg. 4)
 - Versatile LED Configurations, most any (common anode type) configuration of LEDs is compatible.
 - DMX-512 connectivity, 40FPS at full packets, faster with partial packets.
 - Multiple User Selected DMX Reception Modes(8-bit and 16-Bit Mode, with additional features)
 - Serial Reception Mode at user selected baud rate. With RS-485 or TTL reception option.
 - User Selectable PWM Rate, 960Hz, 2KHz, 15khz, or 31KHz at 10-bit(1024 levels) PWM resolution
 - Automatically saves user configurations, options and DMX address, and loads them at startup.
 - External 3 Digit LED Display with 2 buttons for adjusting the configurations and options, such as the DMX reception address.(no DIP switches used, easy to read, and easy to configure)
 - Stand-Alone Sequences, for when no data signal is available, 8 stock sequences to choose from.
 - NLED Control Software Compatibility, connection via the 3-pin header.
- Create and upload(save) custom stand-alone color sequences to the controller from a computer.
- Serviceable Design, in case of any damage caused by accident, including a Full Warranty and Guarantee

Specification:

Input Voltage	5v*, 7v - 24v
Logic Current Draw	< 100mA
Output	4 Channels, Sink
Max Current Per Output	10 Amp**
Max Current Total(all channels)	15 Amp***
PWM Frequency	1kHz to 30kHz****
PWM Resolution	8-bit or 10-bit(DMX only)
Connectors	Screw Terminals, 0.2"(5.08mm)
Connector Spacing	0.1"(Headers) 0.2"(Terminal)
Main PCB Dimension	2.1" x 1.75"
LED Display Dimension	

*5 Volt Input operation possible with minor hardware modification.

**Equivalent to 16 meters of 7.2w/meter(600mA/M) LED strip

***Equivalent to 6.25 meters of 7.2w/meter(600mA/M) LED strip on each output (25 Meters total)

****Selectable through the Options Menu

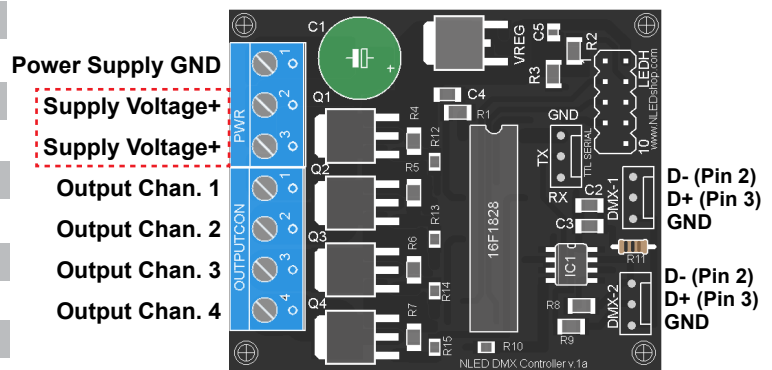


Fig. 1a

Button Use and Options Menu Navigation

Pressing and holding both buttons will open the device menu, where the device configurations and features can be adjusted. When both buttons are pressed and held, the display will indicate by animating “. . .” Once the menu is open(**Enu**) use SW1(left) to cycle through the options and SW2(right) to select an option. For quicker adjustment of the DMX address, both buttons are pressed simultaneously, and released before the menu opens. Adjust the address using the buttons and repeat a quick press of both buttons simultaneously to apply the changes. The configurations are loaded at device startup and saved after a short delay after adjusting them.

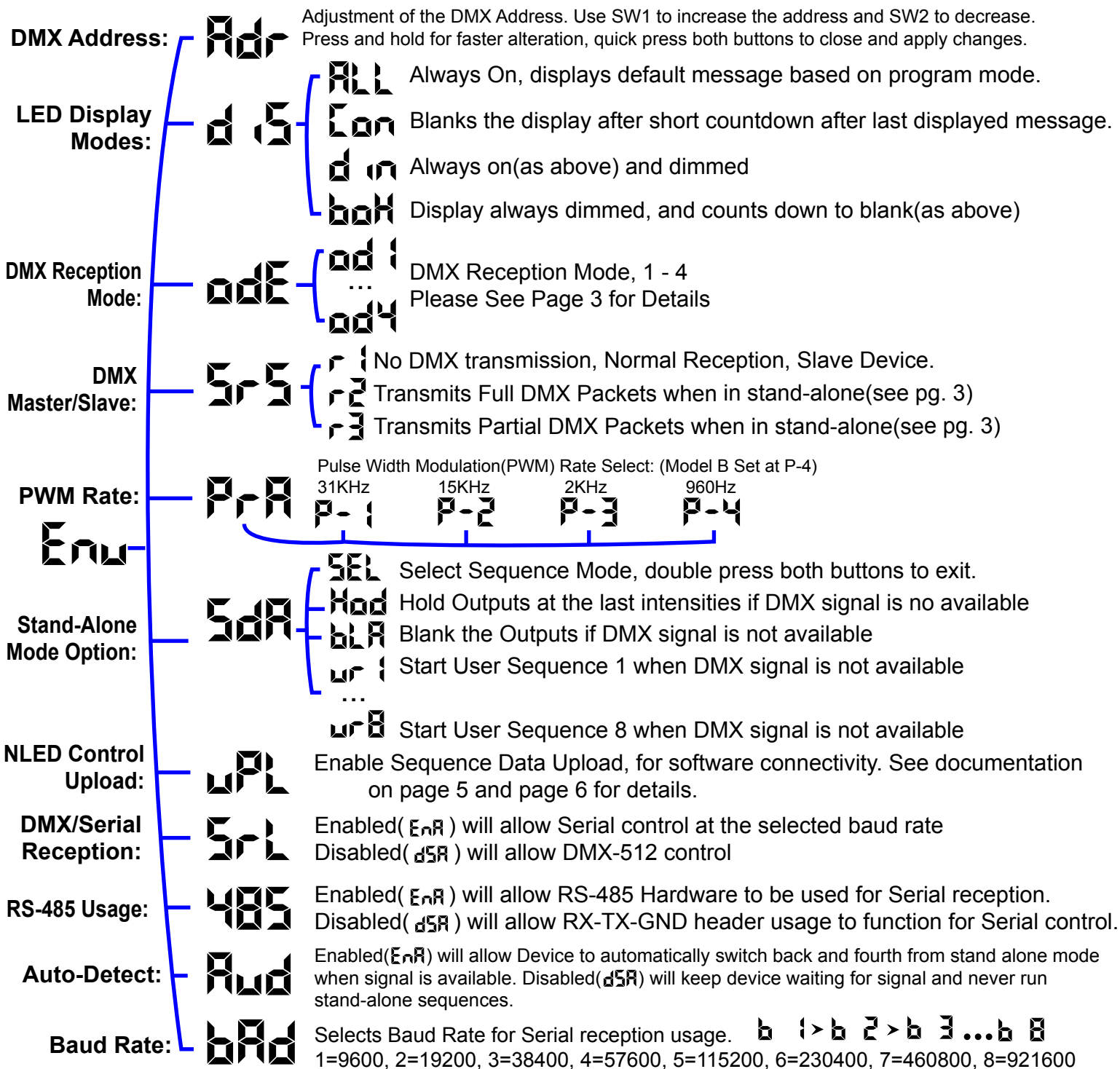


Fig. 2a

DMX Reception Modes

4 Channel Mode: Standard RGBW Usage(od1)

DMX Channel	Function	Value	Description
Channel 1	Red	0 - 255	Red Value, 0 is Off, 255 is Maximum
Channel 2	Green	0 - 255	Green Value, 0 is Off, 255 is Maximum
Channel 3	Blue	0 - 255	Blue Value, 0 is Off, 255 is Maximum
Channel 4	White/UV	0 - 255	Fourth Value, 0 is Off, 255 is Maximum

5 Channel Mode: RGBW Control with Intensity - RGBWA(od2)

DMX Channel	Function	Value	Description
Channel 1	Red	0 - 255	Red Value, 0 is Off, 255 is Maximum
Channel 2	Green	0 - 255	Green Value, 0 is Off, 255 is Maximum
Channel 3	Blue	0 - 255	Blue Value, 0 is Off, 255 is Maximum
Channel 4	White/UV	0 - 255	Fourth Value, 0 is Off, 255 is Maximum
Channel 5	Intensity/Alpha	0 - 255	Scales other channel's Intensity, 0 is 0%, 255 is 100%

3 Channel Mode: Standard RGB Compatibility(od3)

DMX Channel	Function	Value	Description
Channel 1	Red	0 - 255	Red, 0 is Off, 255 is Maximum
Channel 2	Green	0 - 255	Green, 0 is Off, 255 is Maximum
Channel 3	Blue	0 - 255	Blue, 0 is Off, 255 is Maximum

8 Channel, 16-bit Mode: 16-Bit RGBW(od4)

DMX Channel	Function	Value	Description
Channel 1	Red MSB	0 - 255	Most-Significant-Bits of the 16-bit 1st value
Channel 2	Red LSB	0 - 255	Least-Significant-Bits of the 16-bit 1st value
Channel 3	Green MSB	0 - 255	Most-Significant-Bits of the 16-bit 2nd value
Channel 4	Green LSB	0 - 255	Least-Significant-Bits of the 16-bit 2nd value
Channel 5	Blue MSB	0 - 255	Most-Significant-Bits of the 16-bit 3rd value
Channel 6	Blue LSB	0 - 255	Least-Significant-Bits of the 16-bit 3rd value
Channel 7	White/UV MSB	0 - 255	Most-Significant-Bits of the 16-bit 4th value
Channel 8	White/UV LSB	0 - 255	Least-Significant-Bits of the 16-bit 4th value

Note: The maximum PWM resolution is 10-bits(1024 brightness levels), so the 6 LSBs are unused

Need something different? Custom? Contact Support@NLEDshop.com for Help

DMX Transmission Modes



No Master DMX Transmission, device receives normally. As Slave.



Transmits full DMX Universe when in Stand-Alone Mode, transmits the repeating values of the output channels to all DMX channels. 1-4, 5-8, 9-12 up to 512, would all be the same values.



Transmits a partial DMX Universe(256 channels) when in Stand-Alone mode. Same as above but output channel values are repeated 1-4,5-8,9-12 etc up to channel 256.

Note: If a DMX Transmitter is attached to the device(s) it will load the line and Master transmission will not work until the other transmitter is removed from the circuit, and once a device is Master transmitting and DMX transmission is restored, all devices in the universe will act erratically for a few seconds.

LEDs Configuration Examples

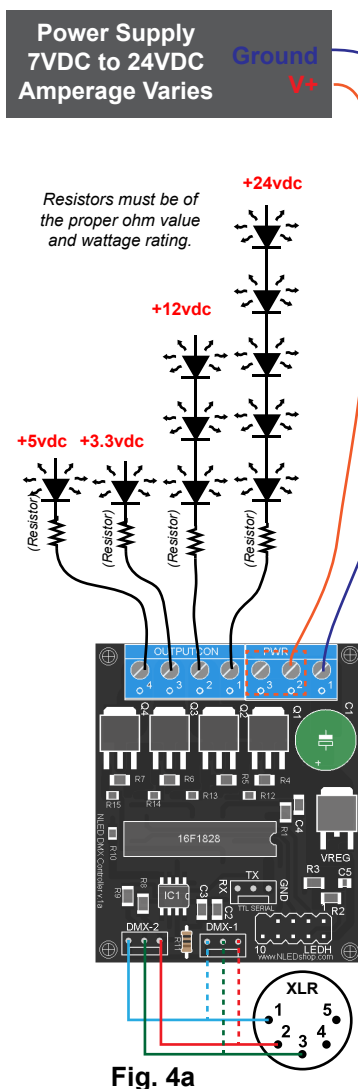
The controller outputs are current sinking, meaning the cathode of the LED(s) or LED string is connected to the controller *Output Channels* and the anode(s) are connected directly to the positive supply voltage. The two *Supply Voltage+* terminal positions are tied together, power must be supplied to either of them. For lower amperage setups, either of the *Supply Voltage+* terminals can be used to supply the positive voltage to the anode(s). For higher amperage usage, attach the anode(s) directly to the positive supply.

Many configurations of LEDs can be controlled. Such as standard 12 volt LED strip or 12 volt RGB LED strip (common anode), series/parallel or single high wattage LEDs (1w, 3w, 5w, 10w, 20w, +more up to max specification) or series/parallel or single 10mm, 5mm LEDs with a current limiting resistors. And multi color LEDs with common anodes.

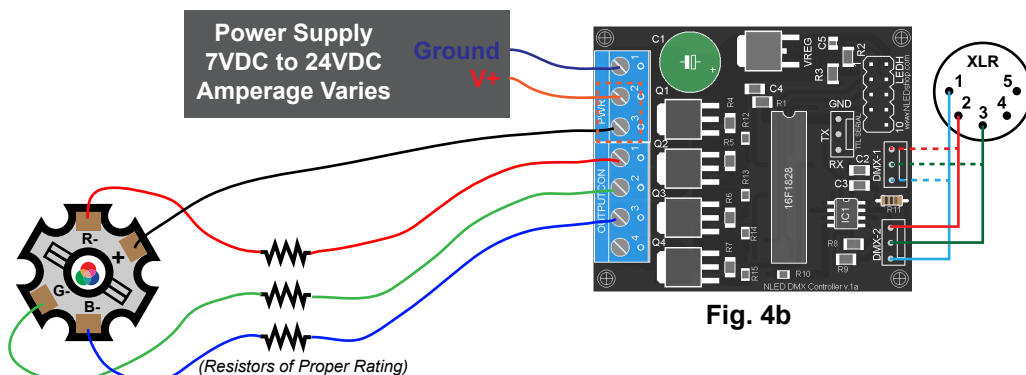
A few configuration examples are shown below. Note DMX-1 and DMX-2 headers are in parallel, either header has the same pinout and are interchangeable. And 3-pin and 5-pin XLR for DMX connections use the same Pin Numbers.

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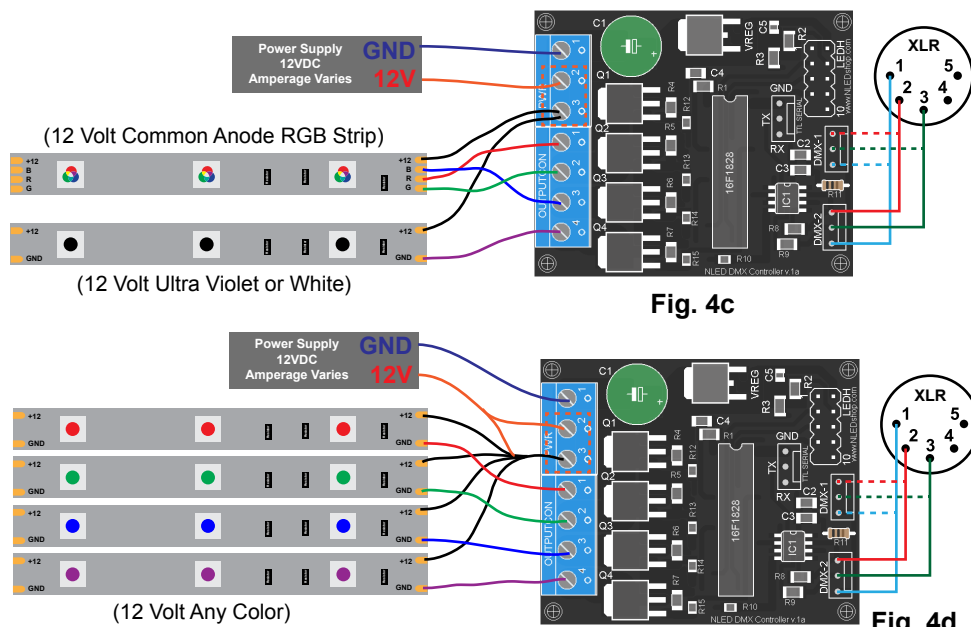
Standard Loose LEDs



Common Anode RGB



Strip LEDs Configuration



Serial Reception Usage

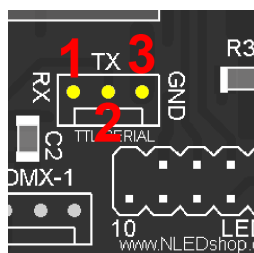
Serial reception can directly control the device's outputs using a common serial transmission device. Such as a standard COM port with level translation, an FTDI adapter, Arduino, PIC UART, wireless XBee, or similar. Data is sent in packets of 4 bytes, with a maximum of 5mS between bytes and a minimum of 5mS between packets. A delay between received data bytes of more than 5mS will reset the buffer pointer, framing the data. Partial packets will latch after the 5mS delay, or latching will occur immediately after receiving the 4th byte.

Serial reception is enabled by selecting Enabled(Enabled) under the Serial(Serial) menu option.(See pg. 2 for details) The stock baud rate is 19,200, but the user can set the utilized baud rate using the menu option(Baud) and referencing the chart on Page 2. The byte formatting is the standard 8-N-1(8-bits, no parity, 1 stop bit)

For serial reception the RS-485 hardware must be configured. RS-485 is a differential transmission method, that DMX-512 utilizes. The user can select through the menu to use the RS-485 hardware for serial reception(transmitting device must be RS-485 as well) on the DMX-1/DMX-2 header or to disable usage and utilize the RX-TX-GND header for direct TTL (Low=0v, High=5v, although 3.3v levels will work as well) control. See page 2 for the details on configuring.

ID#	Common Baud	SPBRG Value	Actual Device Baud	Error %
0	9,600	207	9,615	0.16%
1	19,200	103	19,230	0.16%
2	38,400	51	38,461	0.16%
3	57,600	34	57,142	-0.79%
4	115,200	16	117,647	2.12%
5	230,400	8	222,222	-3.55%
6	460,800	3	500,000	8.5%
7	921,600	1	1,000,000	8.5%

Fig. 5a



RX-TX-GND Header

Connection

- 1 RX ← TX
- 2 TX → RX
- 3 GND ↔ GND

Fig. 5b

Software Connection for Stand-Alone Usage

This device has the ability to run one of eight stand-alone sequences. The stand-alone sequences can be enabled by configuring the device for DMX reception and enabling Auto-Detect. Once those are set, the device will automatically start stand-alone mode after a small delay whenever no DMX signal is available or when it is lost. To select which sequence will run, the menu option(Seq) lists the eight sequence options along with select, hold, and blank. Select the Sel option to manually change through the sequences using the buttons for up and down selection, sequence will run and the sequence number will be displayed. Double press both buttons to exit sequence select mode. To save a Sequence as the default, it must be selected through the menu options normally.

The device is compatible with the software NLED Control. The software is a Java based application that will run on Windows, Mac, and Linux. It requires a TTL serial adapter, such as an USB FTDI adapter, to be connected to the RX-TX-GND header.(as shown above) The software allows the user to create up to 8 sequences on a computer and upload(save) them to the device. The device stores them for use at any time, without the computer connection. Please see the webpage www.NLEDshop.com/nledcontrol

Note: This device has limited usage of NLED Control options. Only Fade and Instant Sequences can be made and not all commands will work on this device, only implemented commands are: Upload Configurations(see next page for special usage), Connect Device, Live Control, and Full Upload. All other commands will be accepted but not affect anything.

Software Connection and Usage(Continued)

Software/Command Usage:

1. Enter Device into Upload Mode, by selecting Enabled(Enabled) from the Upload(Upload) menu option. Or by holding both buttons pressed during power up. It will then display and is then ready for commands.

Or if a LED display is not connected. The device can be forced to enter Upload Mode by tying both buttons to ground(both reds to blue on Fig. 6a). Then powering the device on. Once powered on, remove the jumpers tying the buttons to ground. The device is then ready to accept commands.

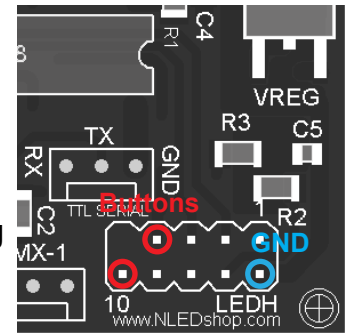


Fig. 6a

2. Connect the RX-TX-GND Header as pictured in Fig. 5b if not already.

3. Once correctly wired to a serial adapter as Fig. 5b and placed in Upload Mode the device will accept and respond to NLED Control commands. See software webpage for command list and usage.

Either the software, NLED Control, can be used to interface with the device. Or the commands can be sent manually using a terminal program. In the case of this device, not all configurations can be altered from the software, so if a LED display is not being used with the controller, the only way to alter some of the configurations is to send manual commands while in Upload Mode. Sending commands is a simple character exchange. The baud in Upload Mode is set in firmware to 19200-8-N-1, regardless of user setting.

Special Command Usage: Upload Configurations - Data1(0 or 1) - Two methods. Data1 of 0, is a regular upload, send all bytes that say(0 or 1) 5 bytes total. Data1 of 1, is a full upload, send entire list, 8 total.

Order of Configuration Bytes to Send

Data1(0 or 1) - DMX Address MSB(Most-Significant-Bits)

Data1(0 or 1) - DMX Address LSB(Least-Significant-Bits)

Data1(0 or 1) - Flags(see Below for bit order)

Data1(0 or 1) - DMX Mode: Value 0 - 3, see page 3.

Data1(1) - SequenceNumber: 0 - 8, what Color Sequence to run when in Stand-Alone

Data1(1) - StandAloneMode: 1 For Run Color Sequence, 2 for Hold Output Values, 3 for Blank Outputs

Data1(1) - PWM Rate: Value of 0x04 is 31Khz, 0x0C is 15kHz, 0x1D is 2KHz, 0x3D is 960Hz

Data1(0 or 1) - BaudRate ID: Values 0 - 8, see Fig. 5a for ID Numbers.

Flags Bit Order from LSB(top) to MSB(bottom):

DisplayModeFlag: 1 = Countdown, 0 = Always On

DisplayDimFlag: 1 = Dim Mode, 0 = Full Brightness

AutoDetectFlag: 1 = Enable Switchover, 0 = Ignore Data/No Switchover to Stand-Alone

RS485Enable: 1 = RS485 enabled with Serial reception, 0 = Serial reception uses RX-TX-GND header

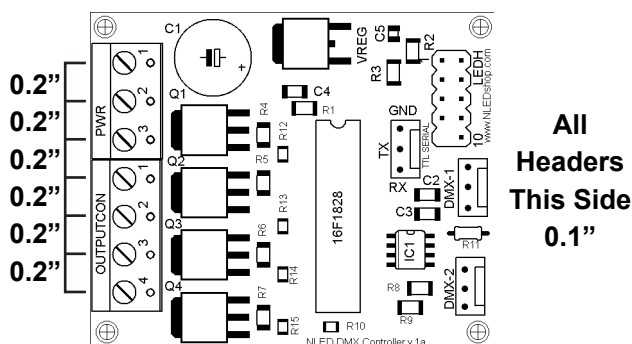
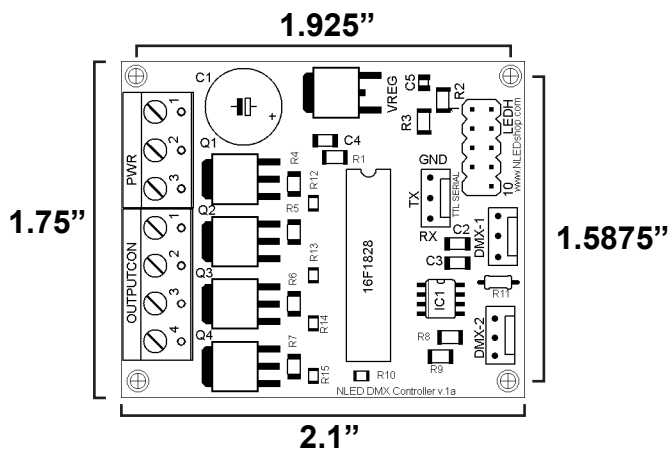
SerialOrDMX: 1 = Recieve Serial, 0 = Recieve DMX

TransmitMode: 1 = Master Transmit, 0 = Recieve normally, Slave

MasterPartialFlag: 1 = DMX Master Transmits full Packets, 0 = DMX Master Transmits Partial Packets

8th bit(MSB) is Unused, set 0

Hardware Dimensions and Connectors



All Headers This Side 0.1"

3-Digit LED Display

The 3-digit LED display is used to adjust the configurations, such as the DMX address. And to display device messages. They are not mandatory for operation, the controller works without it, instructions for adjusting the configuration options without the display is on page 6. But a single LED display could be swapped around on multiple controllers as needed. The datasheet and other information for the 3-Digit LED Display is available on the website. www.NLEDshop.com/extdisplay

Default Messages: If the display is set to be always on (page 2), it will display a default message depending on its current state.

DMX Reception: Displays DMX Address in 3 digit format (001, 089, etc)

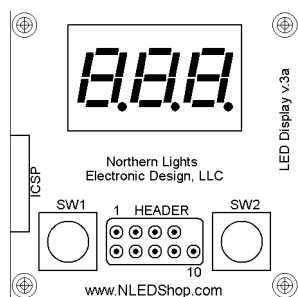
Serial Reception: Cycles displaying `5-1` and current baud rate ID such as `5 2`

Stand-Alone Sequence/Mode: Animates a dash moving across the 3 digits.

Upload Mode: Displays `uPL`

Stand-Alone Hold: Displays `Hold`

Stand-Alone Blank: Displays `blR`



Full Size Version 3a
External LED Display

Print without scaling to
use as a template

OR

Check Website for
vector cutout files for
CNC/Laser cutting.

Power Supply Considerations

Always use a power supply that provides the correct voltage required for your LED configuration. The amperage rating should be at least 10% more than required if the all the outputs were set to maximum intensity at the same time. Ex. 500mA per channel, maximum brightness is: $0.5A \times 4 = 2$ Amps Minimum, so a 2.2 amp or more would be recommended. Contact support with any questions.

The device operates at a high PWM speed, so not all switched mode power supplies may be suitable, check the power supplies datasheet for more information. And always ensure the power supply has proper cooling and/or airflow.

24 Volt Operation

For 24 volt operation the LED Display option for Countdown or Dim, must be enabled. Powering the LED display constantly at full brightness could cause damage to the logic voltage regulator.

Common Issues and Troubleshooting

Please Contact Support@NLEDshop.com with any Questions, Comments, or Bug Reports.

Most issues can be resolved by power off the device, waiting a few seconds, and powering it back up.

Problem: Device with connected LEDs does not produce any light.

First ensure the LEDs are properly powered and wired to the controller. Second ensure there is a data signal or the device is properly set to start stand-alone operation.

Problem: External LED display does not display anything.

Ensure the ribbon cable is seated and plugged in correctly. Try opening the menu by pressing and holding both buttons. If still does not respond, Contact Support.

Problem: External LED display is not displaying certain digit(s)

Ensure the ribbon cable is seated and plugged in correctly. If that does not help, it may be faulty or damaged. Contact Support.

Problem: Serial Control mode is not working

Double check your settings, ensure you have selected Enabled under the Serial(5-1) menu option. Ensure baud rate is the same for the device as with your transmitter, ensure you have properly selected RS-485 usage, see pg. 2 for details.

Problem: DMX Control is not working

Ensure Serial Control is Disabled under the serial menu option. Ensure you have properly set your DMX address. Lastly ensure you have wired your data input correctly.

Problem: Device won't respond to NLED Control commands.

Device is not properly in Upload Mode, see page 6 about configuring Upload Mode through the menu or forcing it at device power up.