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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.

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

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.

Contact

Northlight Systems
Phone 480 429-0577
Email info@NorthlightDMX.com

8 Channel, Digital PWM board

SPECS

Input Signal: Northlight DMXpwm board accepts DMX512A
The pwm board can receive data at the full rate.

Output: Output is 8 PWM channels capable of 256 discrete widths spanning 0 to 100 % duty cycle.
The PWM rate 400 Hz.

Address switch: Mini DIP switche

Power requirements: 7 to 12 volts DC @ 60 mA. Max. for controller board only. LOAD power varies.

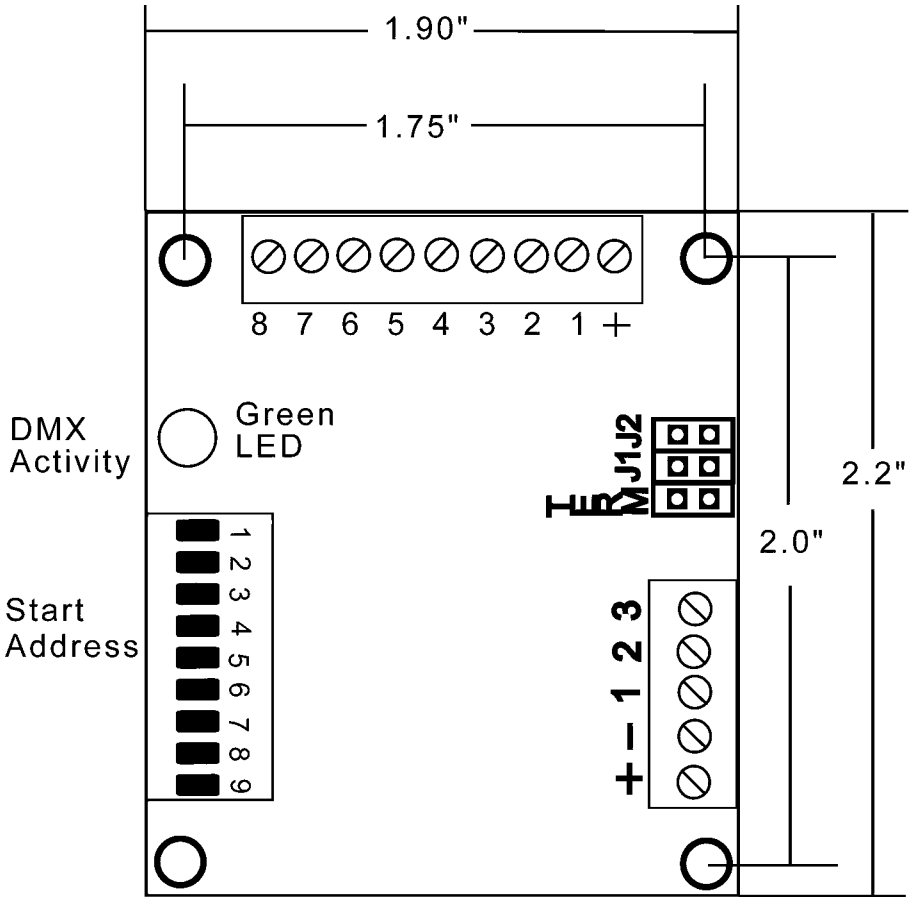
LED Indicators: Green LED - DMX signal activity.

Board connections: All connections are made width mini screw terminals. See drawing for connector locations.

Physical Dimensions

2.15”L X 1.90”W +/- . 10”
The **DMX input** pin numbers correspond to the XLR pin numbers.

The **Common** connector is signal ground – not earth ground.



Using the pwm board

Board Power Input

7 to 12 volts DC @ 60 mA. MAX current, for the board. On average the current consumption is around 50 mA.
The signal ground connector is the common signal ground – not earth ground.

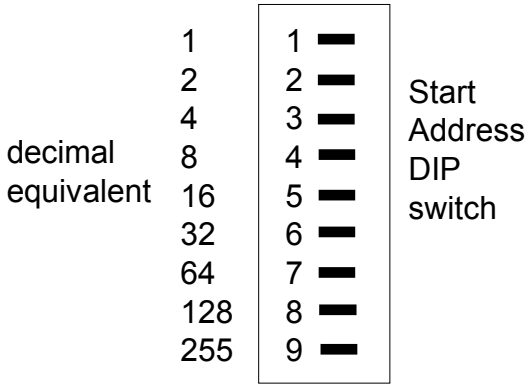
DMX512 In

The DMX input pin numbers correspond to the XLR pin numbers.
Pin 1 is signal ground, not earth ground
Pin 2 is DMX512 -
Pin 3 is DMX512 +

Setting the start address

Set the starting address to the first in a group of 8.
The address is entered on the DIP switches in standard binary code starting with 0. See the chart of all 512 address switch positions at the back of this manual.

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



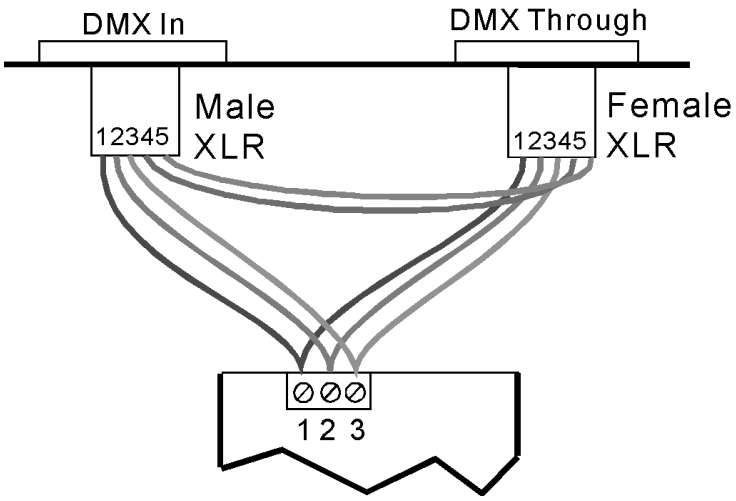
To set the DMX output address to 131 set switches 8 and 2, to ON. Switch 8 = 128, add switch 2 = 130, then add 1 = address 131

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

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



Using the configuration jumpers

There are 2 configuration jumpers on the board.

J1 – Determines the output in the event of DMX signal loss.
Open(no jumper) - When the DMX signal is lost, the relays will open.
Closed(jumper in place) – When the DMX signal is lost the relays will hold the last valid data.

J2 – Determines whether the output is PWM or non-PWM , relay mode.
Open(no jumper) – This is the default setting.
All outputs are PWM.
Closed(jumper in place) – Each output is low when the DMX level is below 75% (DMX 192) and goes high when the MX level is over %75.

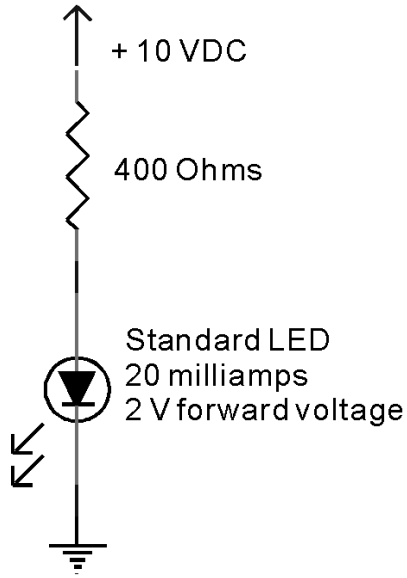
Using LED's

LED's are current controlled devices. The more current passing through the LED the brighter it is. Standard LED's usually require 15 to 20 milliAmps(mA) to reach full briteness. High efficiency LED's may only require 5-10 mA. Blue and white LED's often require 30-50 mA to reach full briteness.

A minimum voltage is required before a LED will illuminate. This is refereed to as "VF" or the "forward voltage. On a standard LED the forward voltage usually varies from 1.2 to 2.7 volts. Blue and white LED's usually have a VF of 3.3v.

A resistor must be used in series with the LED to prevent excessive current flow. The value of the resistor is dependent on the power supply voltage, the amount of current required and the VF of the LED.

To calculate the resistor us the formula below:
Vs – Vf / If
Where Vs = power supply voltage
Vf is the forward voltage of the LED
If is the desired current.



Example: Red LED with forward voltage of 2VDC at 20 mA with 10 volt supply
10V – 2V = 8v
8V /.02Amps = 400
The correct resistor = 400 Ohms

Resistors also have a watt rating. This the total power the resistor can handle without overheating.

Ohms law states the formula for watts is I(amps) X V(volts) = Watts.

In the example, .02Amps X 2volts(vF) = .04 watts. A standard ¼ watt resistor is fine for a single LED.
When using many LED's in an array a larger wattage resistor will probably be needed.

Luxeon Star Example

A standard Luxeon star is rated at 3.3VDC Vf at 350 milliamps.

Example with 12 vdc power supply.
12 – 3.3 = 8.7 volts
8.7/.350 = 2.48 Ohms
8.7 X .350 = 3.04

In this example use a 2.5 Ohm 3 watt resistor

A 3 - 5 watt metal film resistor is common.

Multi-LED circuits

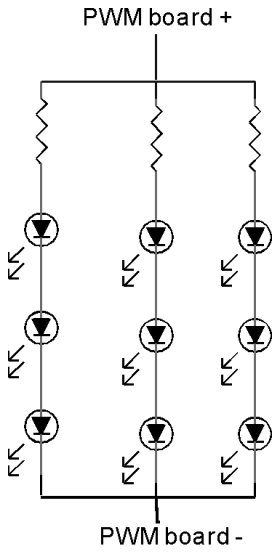
If many LED's need to be driven on a single output channel this can be done by wiring the LED's in series.
Wiring LED's in series requires the supply voltage to be higher than the sum of the individual LED forward voltages. Series wired LED's consume a minimum amount of current, but there are limits to the number of LED that can be wired in series.
It is possible to use a parallel and series arrangement as shown in the drawing below.

In the example shown there are 3 series LED in 3 parallel arrangement.
Example using blue LED:
Each LED has a forward voltage of 3.3 VDC.
Each LED requires 30 milliamps

The supply voltage has to be higher than
3 X 3.3vf = 9.9 VDC minimum
it should supply more than 9 X 30 milliamps for 270 milliamps total

The calculate the value for each resistor
With a 12 volt supply

VS = 12 VDC
12Vs – 9.9Vf = 2.1V
2.1V / .09A = 23.3 Ohms
27 Ohms is a common value



watt = 2.1V X .09A = .189W
a standard ¼ watt resistor will be fine for this example.

3 – ¼ watt, 23 or 24 Ohm resistors will work for 9 Blue LED.

4 Lead RGB LED

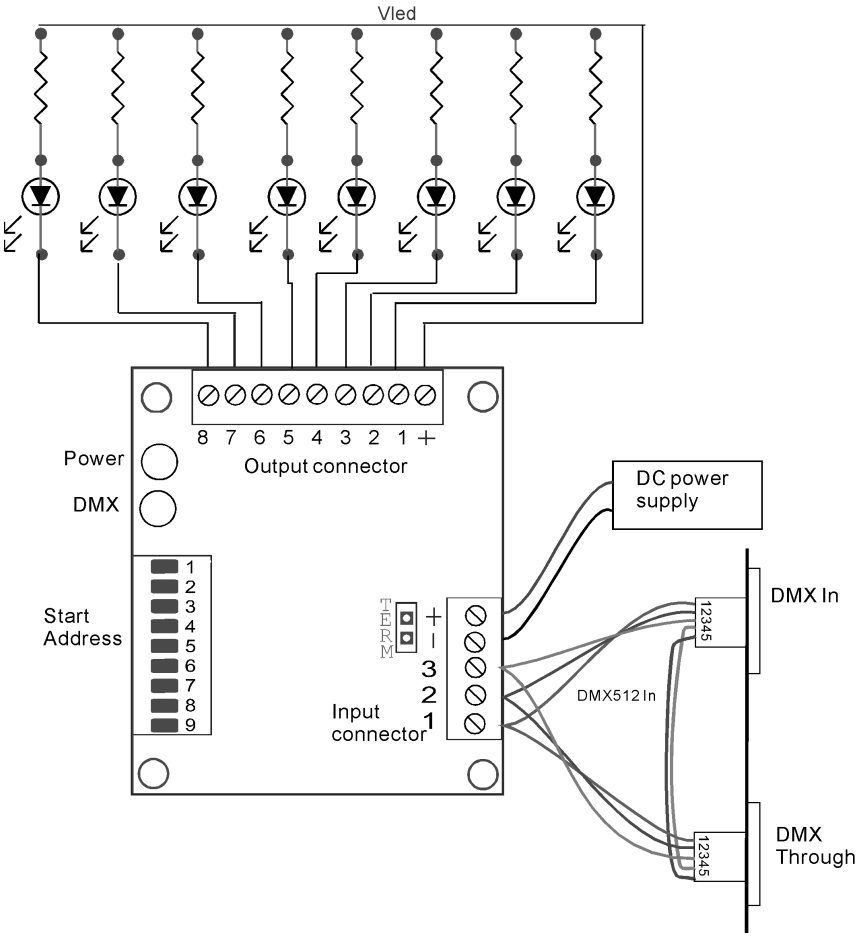
4 lead RGB LED should be common anode type. They must be wired in parallel.

Typical hook up

The PWM board uses an ULN2803 open collector Darlington array as the power switch. It is capable of switching 60 mA per channel with all 8 channels driven or 500 mA total current for the chip.

The LED resistors are dependent on the current required.

Note: The V+ terminal on the output connector is directly connected the the V+ terminal on the input connector. Therefor the input voltage is the LED voltage. The power supply should have enough current to power all the LED's and the controller board.



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 PWM provides an on board terminator using standard square header pin connectors on .10” centers.

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

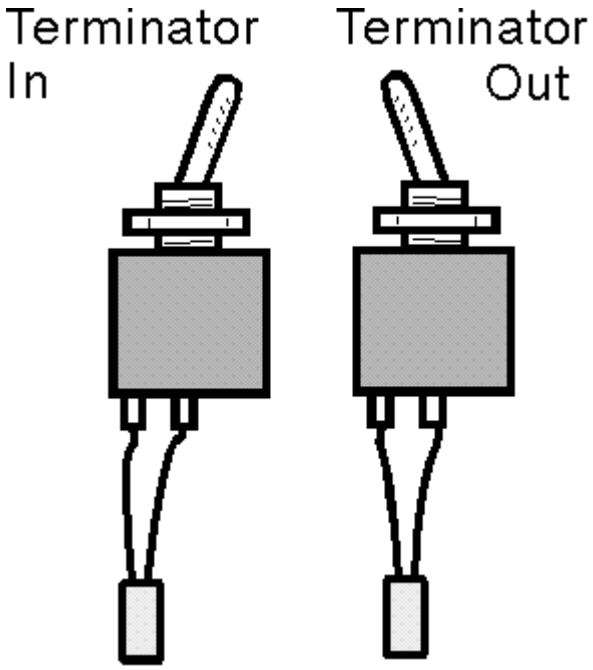
The termination resistor should only be in when the decoder is the last device on the DMX link.

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”.

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



Trouble shooting

Basically the board is plug and play. When all connections are properly made, an variable pulse, 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: If the PWM 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 DMXpwm start address should not be higher than the highest address received.

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 for DMX512. Reverse the connections.

Misc: Good solid connections are a must. The mini 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 DMXpwm board. Occasionally unexpected problems can occur if power is ”borrowed” from another source. Small wall wart transformers work well for this application.

Using 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 PWM board 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 refereed 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 PWM board 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 outputs 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 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 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 wire type. You can use a range of wire gauges, 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.

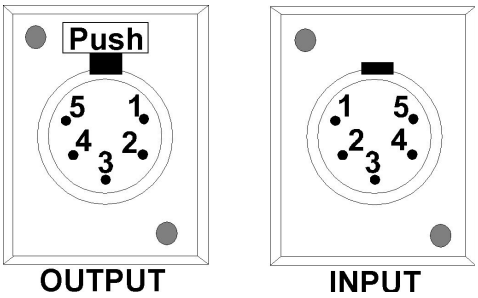
Connectors

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.

PIN	WIRE	SIGNAL
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.



Address - Switches	Address - switches	Address - switches	Address - switches
1 =1	64 = 7	127 = 1, 2, 3, 4, 5, 6, 7	190 = 2, 3, 4, 5, 6, 8
2 =2	65 = 1, 7	128 = 8	191 = 1, 2, 3, 4, 5, 6, 8
3 = 1, 2	66 = 2, 7	129 = 1, 8	192 = 7, 8
4 =3	67 = 1, 2, 7	130 = 2, 8	193 = 1, 7, 8,
5 = 1, 3	68 = 3, 7	131 = 1, 2, 8	194 = 2, 7, 8,
6 = 2, 3	69 = 1, 3, 7	132 = 3, 8	195 = 1, 2, 7, 8
7 = 1, 2, 3	70 = 2, 3, 7	133 = 1, 3, 8	196 = 3, 7, 8
8 = 4	71 = 1, 2, 3, 7	134 = 2, 3, 8	197 = 1, 3, 7, 8
9 = 1, 4	72 = 4, 7	135 = 1, 2, 3, 8	198 = 2, 3, 7, 8
10 = 2, 4	73 = 1, 4, 7	136 = 4, 8	199 = 1, 2, 3, 7, 8
11 = 1, 2, 4	74 = 2, 4, 7	137 = 1, 4, 8	200 = 4, 7, 8,
12 = 3, 4	75 = 1, 2, 4, 7	138 = 2, 4, 8	201 = 1, 4, 7, 8
13 = 1, 3, 4	76 = 3, 4, 7	139 = 1, 2, 4, 8	202 = 2, 4, 7, 8
14 = 2, 3, 4	77 = 1, 3, 4, 7	140 = 3, 4, 8	203 = 1, 2, 4, 7, 8
15 = 1, 2, 3, 4	78 = 2, 3, 4, 7	141 = 1, 3, 4, 8	204 = 3, 4, 7, 8
16 = 5	79 = 1, 3, 4, 7	142 = 2, 3, 4, 8	205 = 1, 3, 4, 7, 8
17 = 1, 5	80 = 5, 7	143 = 1, 2, 3, 4, 8	206 = 2, 3, 4, 7, 8
18 = 2, 5	81 = 1, 5, 7	144 = 5, 8	207 = 1, 2, 3, 4, 7, 8
19 = 1, 2, 5	82 = 2, 5, 7	145 = 1, 5, 8	208 = 5, 7, 8
20 = 3, 5	83 = 1, 2, 5, 7	146 = 2, 5, 8	209 = 1, 5, 7, 8
21 = 1, 3, 5	84 = 3, 5, 7	147 = 1, 2, 5, 8	210 = 2, 5, 7, 8
22 = 2, 3, 5	85 = 1, 3, 5, 7	148 = 3, 5, 8	211 = 1, 2, 5, 7, 8
23 = 1, 2, 3, 5	86 = 2, 3, 5, 7	149 = 1, 3, 5, 8	212 = 3, 5, 7, 8
24 = 4, 5	87 = 1, 2, 3, 5, 7	150 = 2, 3, 5, 8	213 = 1, 3, 5, 7, 8
25 = 1, 4, 5	88 = 4, 5, 7	151 = 1, 2, 3, 5, 8	214 = 2, 3, 5, 7, 8
26 = 2, 4, 5	89 = 1, 4, 5, 7	152 = 4, 5, 8	215 = 1, 2, 3, 5, 7, 8
27 = 1, 2, 4, 5	90 = 2, 4, 5, 7	153 = 1, 4, 5, 8	216 = 4, 5, 7, 8
28 = 3, 4, 5	91 = 1, 2, 4, 5, 7	154 = 2, 4, 5, 8	217 = 1, 4, 5, 7, 8
29 = 1, 3, 4, 5	92 = 3, 4, 5, 7	155 = 1, 2, 4, 5, 8	218 = 2, 4, 5, 7, 8
30 = 2, 3, 4, 5	93 = 1, 3, 4, 5, 7	156 = 3, 4, 5, 8	219 = 1, 2, 4, 5, 7, 8
31 = 1, 2, 3, 4, 5	94 = 2, 3, 4, 5, 7	157 = 1, 3, 4, 5, 8	220 = 3, 4, 5, 7, 8
32 = 6	95 = 1, 2, 3, 4, 5, 7	158 = 2, 3, 4, 5, 8	221 = 1, 3, 4, 5, 7, 8
33 = 1, 6	96 = 6, 7	159 = 1, 2, 3, 4, 5, 8	222 = 2, 3, 4, 5, 7, 8
34 = 2, 6	97 = 1, 6, 7	160 = 6, 8	223 = 1, 2, 3, 4, 5, 7, 8
35 = 1, 2, 6	98 = 2, 6, 7	161 = 1, 6, 8	224 = 6, 7, 8
36 = 3, 6	99 = 1, 2, 6, 7	162 = 2, 6, 8	225 = 1, 6, 7, 8
37 = 1, 3, 6	100 = 3, 6, 7	163 = 1, 2, 6, 8	226 = 2, 6, 7, 8
38 = 2, 3, 6	101 = 1, 3, 6, 7	164 = 3, 6, 8	227 = 1, 2, 6, 7, 8
39 = 1, 2, 3, 6	102 = 2, 3, 6, 7	165 = 1, 3, 6, 8	228 = 3, 6, 7, 8
40 = 4, 6	103 = 1, 2, 3, 6, 7	166 = 2, 3, 6, 8	229 = 1, 3, 6, 7, 8
41 = 1, 4, 6	104 = 4, 6, 7	167 = 1, 2, 3, 6, 8	230 = 2, 3, 6, 7, 8
42 = 2, 4, 6	105 = 1, 4, 6, 7	168 = 4, 6, 8	231 = 1, 2, 3, 6, 7, 8
43 = 1, 2, 4, 6	106 = 2, 4, 6, 7	169 = 1, 4, 6, 8	232 = 4, 6, 7, 8
44 = 3, 4, 6,	107 = 1, 2, 4, 6, 7	170 = 2, 4, 6, 8	233 = 1, 4, 6, 7, 8
45 = 1, 3, 4, 6	108 = 3, 4, 6, 7	171 = 1, 2, 4, 6, 8	234 = 2, 4, 6, 7, 8
46 = 2, 3, 4, 6	109 = 1, 3, 4, 6, 7	172 = 3, 4, 6, 8	235 = 1, 2, 4, 6, 7, 8
47 = 1, 2, 3, 4, 6	110 = 2, 3, 4, 6, 7	173 = 1, 3, 4, 6, 8	236 = 3, 4, 6, 7, 8
48 = 5, 6	111 = 1, 2, 3, 4, 6, 7	174 = 2, 3, 4, 6, 8	237 = 1, 3, 4, 6, 7, 8
49 = 1, 5, 6	112 = 5, 6, 7	175 = 1,2, 3, 4, 6, 8	238 = 2, 3, 4, 6, 7, 8
50 = 2, 5, 6	113 = 1, 5, 6, 7	176 = 5, 6, 8	239 = 1, 2, 3, 4, 6, 7, 8
51 = 1, 2, 5, 6	114 = 2, 5, 6, 7	177 = 1, 5, 6, 8	240 = 5, 6, 7, 8
52 = 3, 5, 6	115 = 1, 2, 5, 6, 7	178 = 2, 5, 6, 8	241 = 1, 5, 6, 7, 8
53 = 1, 3, 5, 6	116 = 3, 5, 6, 7	179 = 1, 2, 5, 6, 8	242 = 2, 5, 6, 7, 8
54 = 2, 3, 5, 6	117 = 1, 3, 5, 6, 7	180 = 3, 5, 6, 8	243 = 1, 2, 5, 6, 7, 8
55 = 1, 2, 3, 5, 6	118 = 2, 3, 5, 6, 7	181 = 1, 3, 5, 6, 8	244 = 3, 5, 6, 7, 8
56 = 4, 5, 6	119 = 1, 2, 3, 5, 6, 7	182 = 2, 3, 5, 6, 8	245 = 1, 3, 5, 6, 7, 8
57 = 1, 4, 5, 6	120 = 4, 5, 6, 7	183 = 1, 2, 3, 5, 6, 8	246 = 2, 3, 5, 6, 7, 8
58 = 2, 4, 5, 6	121 = 1, 4, 5, 6, 7	184 = 4, 5, 6, 8	247 = 1, 2, 3, 5, 6, 7, 8
59 = 1, 2, 4, 5, 6	122 = 2, 4, 5, 6, 7	185 = 1, 4, 5, 6, 8	248 = 4, 5, 6, 7, 8
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61 = 1, 3, 4, 5, 6	124 = 3, 4, 5, 6, 7	187 = 1, 2, 4, 5, 6, 8	250 = 2, 4, 5, 6, 7, 8
62 = 2, 3, 4, 5, 6	125 = 1, 3, 4, 5, 6, 7	188 = 3, 4, 5, 6, 8	251 = 1, 2, 4, 5, 6, 7, 8
63 = 1, 2, 3, 4, 5, 6	126 = 2, 3, 4, 5, 6, 7	189 = 1, 3, 4, 5, 6, 8	252 = 3, 4, 5, 6, 7, 8

Address - switches
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329 = 1, 2, 3, 4, 5, 6, 9
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Address - switches
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