Introduction to DMX

Kevin "Wirekat" Thomas
ChristmasInKent.com

What is DMX?

What is DMX?

- **D**igital **M**ultiple**X**ed Signals
  - A Protocol (language) created to standardize theatrical lighting in 1986
    - 512 data packets sent 44 times/second using EIA-485 serial - blah blah blah
  - Digital control of lights, strobes, foggers, lasers...
  - Signal consists of "packets" of data
  - DMX fixtures/devices receive signal and decode
    - They "listen" for their "addresses"
    - They preform the action based on the "value" sent
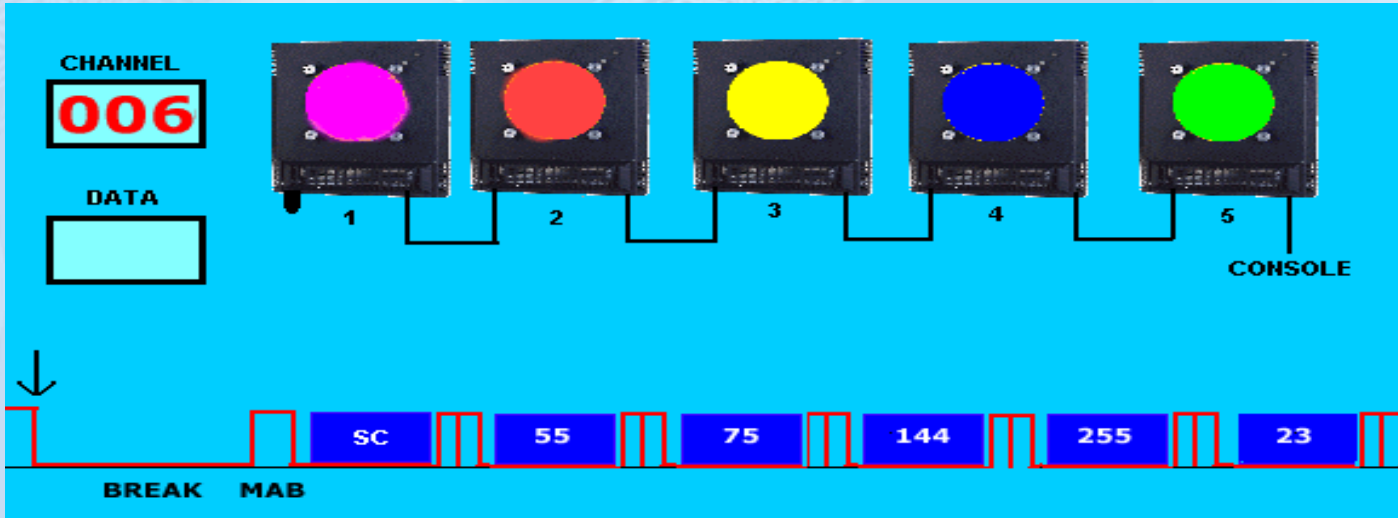   - They wait for another command

Packets?

- Signal consists of "packets" of data
  - Packets are coded with an "Address" (channel) & "Value"
  - 512 possible channels with 256 values / channel
  - Signal is sent down the "wire" from a console or computer
  - All DMX devices receive the same signal
  - Signal is constant and One-Way
  - Device listens for it's address(es)
  - Multiple Devices with Multiple Channels are possible
  - Limits? 512 channels, 32 devices & 3,900' cable runs

ChristmasExpo

Packets?

A DMX Universe

- One Universe = 512 channels
- DMX Theatrical "Fixtures"
  - Fixtures can use one or more channels
    - On / Off / Intensity / Ramp / Speed / Movement
    - Dumb have basic functions = on / off / speed / intensity / macros / sound activation
    - Smart fixtures use more channels = intelligence
  - Each Channel - range of values from 0 to 255 (256 values)
    - Intensity - Zero is usually OFF & 255 is usually 100% ON
    - Other functions may only use a few values

DMX Theatrical Fixtures

- Dimmer pack – control of high amperage lights
  - On / Off / Intensity / Ramp / Speed
  - Lights plug into the Dimmer Pack

ChristmasExpo

DMX Theatrical Fixtures

- LED Spots/Floods/Panels – RGB LEDs in a matrix

ChristmasExpo

DMX Theatrical Fixtures

- Strobes – control flash rate, intensity…

DMX Theatrical Fixtures
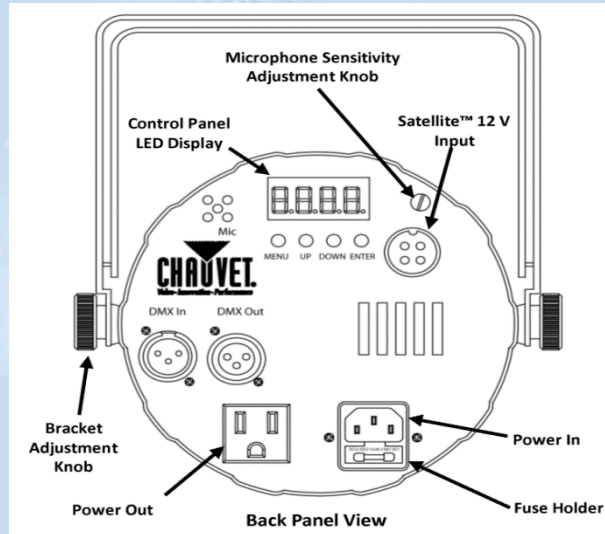
- Moving head spot lights

DMX Theatrical Fixtures

- Many types of DMX fixtures, controllers...

Fixture, Function & Address

- Each fixture = unique address in a DMX universe
- Fixture may use different number of channels

DMX Fixture Functions

DMX Values

7-CH

Channel	Function	Value	Percent/Setting
1	Red	000 ⇔ 255	0~100%
2	Green	010 ⇔ 255	0~100%
3	Blue	030 ⇔ 255	0~100%
4	Color Macros (Overrides Ch 1~3)	000 ⇔ 015	No function
		016 ⇔ 255	Color Macros
5	Speed (When Ch. 6 is 032~223)	000 ⇔ 255	Slow~fast
	Strobe	001 ⇔ 015	No function
		016 ⇔ 255	Slow~fast
6	Mode	000 ⇔ 031	RGB mode
		032 ⇔ 063	Pulse effect 0~100%
		064 ⇔ 095	Pulse effect 100%~0
		096 ⇔ 127	Pulse effect 100%~0~100%
		128 ⇔ 159	Auto fade transition
		160 ⇔ 191	Auto snap transition (3 colors)
		192 ⇔ 223	Auto snap transition (7 colors)
		224 ⇔ 255	Sound-active mode
7	Dimmer	000 ⇔ 255	0~100%

3-CH

Channel	Function	Value	Percent/Setting
1	Red	000 ⇔ 255	0~100%
2	Green	000 ⇔ 255	0~100%
3	Blue	000 ⇔ 255	0~100%

DMX Fixture Settings

https://www.chauvetdj.com/chauvet-dj-dip-switch-calculator/

DMXcatTM app

DMX Fixture Control (old school)

- Sliders for setting values
- Each slider sends a signal from 0 to 255

RGB - DMX Universe

- One DMX universe is 512 channels
- RGB Controllers (dumb – no data output)
  - RGB Controllers can use three or more channels
    - 3, 4, 9, 24, 27, 30 - Multiples of 3 for RGB
    - Intensity control only
  - Each Channel - range of values from 0 to 255 (256 values)
    - Zero is OFF – 255 is 100% ON
    - Color Mixing
    - Each RGB's (Red Green Blue) intensity can be adjusted to achieve "ANY" color!
      - Within the limits of the particular LED, software, controller, blah blah blah
  - 27 Channel Controller = 9 RGB "channels"

27 Channel Dumb RGB Controller

DMX In/Out

DMX In/Out

DIP

Power IN

R/G/B/Common X 9 = 27 channels

- DMX signal – set starting address on DIP switches
- DC Power Supply – 5 volt or 12 volt is common
- Dumb RGB strings – 4 conductor – Common + R + G + B
- Enclosure, pigtails, 4 conductor wire (solder, heat shrink…)

DMX Holiday Lighting Control

- DMX Program on your Computer
  - Software – LOR, X-Lights, Madrix, Vixen...
  - Dongles
    - LOR USB485 (or iDMX) USB connection
    - DMX dongle (Enttec standard) USB connection)
    - No Dongle - E1.31 – Network Cat5 + Converter = DMX
  - Cabling
  - Controllers, Fixtures and/or Lights
    - 3, 9, 27, 30 channel DMX (dumb) controller
    - Fixture – Theatrical or DIY spot...

ChristmasExpo

DMX Connections

- Signal – Power – Lights (Protected from the elements)
- DMX fixture
  - LED flood
    - DMX cable (5 pin) or XLR (3 pin) or Cat5 & adapter
    - Power – 110 volt AC
    - May have to control **power feed** to a "theatrical" fixture
- DMX light controller (DMX27, LOR, Lynx...)
  - DMX cable – Cat5 or DMX cable (3 pin)
  - Power – 5 volt DC, 12 volt DC, 110 volt AC
  - Lights – LED strips, modules, pixels – incan. (Lynx)

Christmas Expo

DMX Cabling

- Cat5 with RJ45 connectors – check pinout
- DMX cables (120 ohm double braided shielding)
  - XLR (microphone) cables are 45-70 ohms
    - Not approved by the blah blah blah
  - Most fixtures use a 3 pin connector (Enttec = 5)
- 1000' – 1,500' limit – depends on cable and fixtures
- Terminate! (120 ohm across pins 2 & 3)
- Use opto splitters not Y connectors
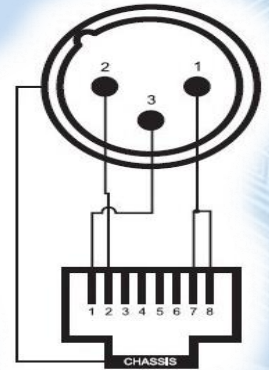- Wireless – DIY Lynx, ENTTEC, eBay, Chauvet…
- Adapters

ChristmasExpo

DMX Cabling Pinout

	Connector Type												
	XLR		Std DMX	RPM USB to DMX	DMX Splitter 1 in 4 out	LOR	RJ45 RENARD					PIXC	Pixels
	5 Pin	3 Pin					48LSD	8 (XA)	SS8(1.1); 16(1.91); S16(1.0); 24(V33); 24LV; SS24(1.1); 64(X1,XA,XB); 595Conv[Renc](2.0.2); T(2.5)	W	Rel (2.2)		
Channel 1 Data +	3	3	1	1	1	4	5	4	5	4	5		8 Channel 1 Data +
Channel 1 Data -	2	2	2	2	2	5	4	5	4	n/a	4		7 Channel 1 Data -
Channel 1 Gnd	1	1	7/8	7	7	6		1,2	1,2	1,2	1,2		2 Channel 1 Gnd
Channel 2 Data +	5		3										4 Gnd
Channel 2 Data -	4		6										5 Gnd
Channel 2 Gnd	1		7/8										1 +12 V
UNASSIGNED				4									3 +12 V
UNASSIGNED				5									6 +12 V
+9V						3							

ChristmasExpo

DMX Cable Adapters

DMX Software Programming

- Software that can Program shows & send DMX signals
- All require DMX dongle or E1.31 network connection
  - Light-O-Rama www.lightorama.com
  - xLights   www.xlights.org
  - Vixen   www.vixenlights.com
  - Madrix   www.madrix.com

DMX Dongles?

- Computer software generates DMX signals via:
  - Dongles
    - Light-O-Rama iDMX on an LOR network
    - LOR controllers can accept DMX (firmware 4.20 > special pinout)
    - Enttec, Enttec Pro and compatible
    - DIY Lynx DMX Dongle
    - ActiDongle – HolidayCoro
    - Ebay…

ChristmasExpo

My DMX History

- I used ten DMX fixtures (Chauvet 200B – 199 LEDS 67R, 66G, 66B)
  - 10 X 6 channels each = 60 channels
- 8 DMX Lynx controllers
  - 8 X 16 = 128 channels
- Two 800 watt DMX strobes - 2 channels (rate & intensity)
- 3 dumb pixel stick trees.
  - 9 layers of branches X 3 = 27 channels
- 273 channels (with three stick trees) Only ONE Universe!!!
  - TSO used over 2,000 DMX fixtures during their 2008 season. Average 10 channels / fixture = 20,000 channels. Now they have hundreds of thousands of channels.
  - An average pixel mega tree uses 24 strings of 100 pixels each for 24 X 100 X 3 = 7,200 but a large pixel tree can be 150 X 36 X 3 = 16,200 channels (32 DMX universes).

ChristmasExpo

My DMX Fixtures

My DMX Fixtures

My DMX 27 channel trees

24 channel singing trees

HolidayCoro.com

RGB Singing
Christmas Tree

(C) HolidayCoro.com 2013

Christmas Expo

12 Channel Exploding Star

Flat Pixel Tree 3,600 channels

24 Channel Singing Trees

3 - 27 Channel Color Trees

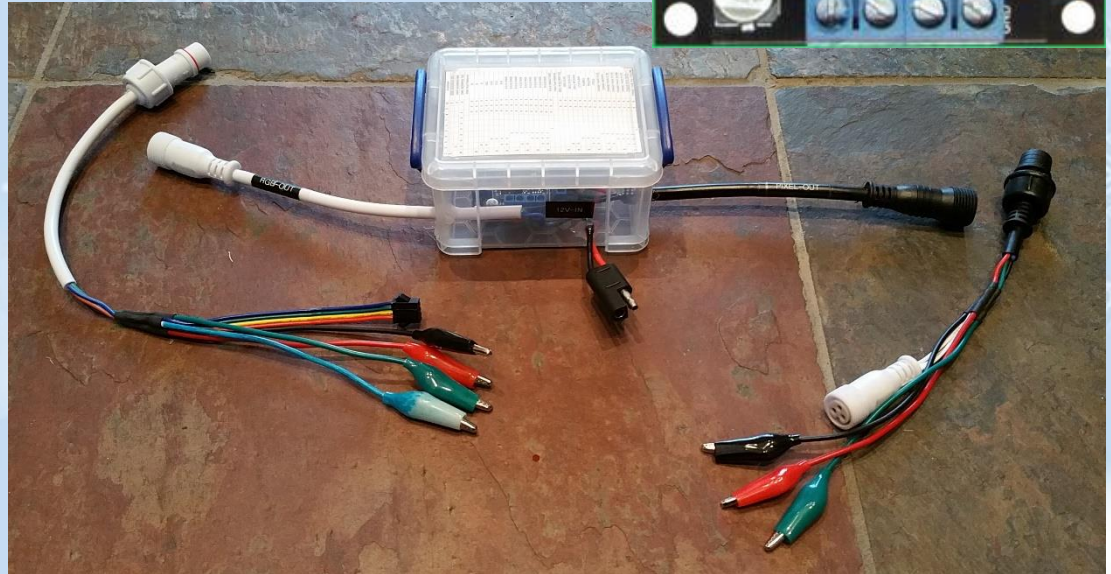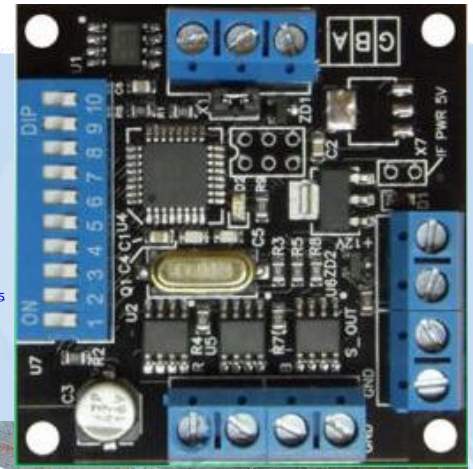Pixel Grid (4,608) = 13,824 channels

Pixel Arches = 1,746 channels

DMX in my show:

3 – dumb pixel trees
3 – exploding stars
6 – pixel arches
5 – singing trees
1 – pixel grid
1 – smart pixel tree
1 – 6 headed DMX strobe
1 – DMX snow machine

DMX Testing

https://www.ebay.com/itm/DMX-512-decoder-driver-3-ch-24A-DMX-to-1903-WS2812-WS2813-SK6812-SM16703/221221956275

https://www.ebay.com/itm/DMX-512-Signal-Tester-and-Lighting-Terminator-XLR-3-Pin/200914384485

Advanced DMX ???

- How do I control my pixel tree?
  - It has 12 strings of 100 smart pixels or 3,600 channels
  - 12 X 100 X 3 = 3,600 channels or 8 universes of DMX
- DMX over IP – E1.31 - Ethernet
  - Multiple universes over a single cat5
    - Using your standard network infrastructure – NIC cards, hubs…
- Raspberry Pi Zero W - Pixel hat