E.L.F. Handbook

Version 0.1.5

Introduction

A light display can mean anything from a few lights in your window to a fully sequenced show involving multiple houses, moving heads AND FIREWORKS, it's easy to get overwhelmed, excited and start buying loads of crap (I know I did)

The E.L.F. Facebook group is designed to be a space where a bunch of like minded light enthusiasts can discuss, debate and chat about techniques, sequences and building better displays, we are a very welcoming group (although we would say that)

There is no knowledge level requirement or specific technology / hardware (although there are preferences) but remember when asking questions that people are using their free time to help.

The E.L.F. group holds weekly Zoom training sessions that both cover helpful how tos and answering individual questions and solving problems, you can see the complete video archive below.

Everything in this guide is just that; a guide, suggestion or hint, there are always many ways of doing something and 90% of the time it comes down to personal preference, technology confidence level, available time and ultimately your budget/willingness to spend.

The final things to remember before you begin is this

99% of those who see your lights will be impressed with the fact they change colour, focus on getting SOMETHING up and working and then expand when that's done. It is not a competition with other lighters!

Terminology

As with any Hobby or community, there becomes almost a second language of terms that are 'known' and by just coming into the hobby it can take a while to understand, below we've started to put some of the commonly used terms so you can quickly get to speed with the discussions (and some of the community jokes)

- **5v / 12v** - the two most common power types when it comes to Pixels, don't ask which is better (it's 12v)
- **BALS** - *Build a Light Show - The official UK supplier of almost all the Holiday lighting stuff from America*
- **Bullets -** *A type of pixel (this is the difference between the EU and the USA groups)*
- **Controller** - *A hardware device used to manage the pixels and power distribution (i.e. an F16v3, Raspberry Pi or Arduino based device)*
- **Coro / Correx -** *The plastic based material that many props are build it, when supplied from a reputable manufacturer they are often weather treated and will last many seasons*
- **DMX -** *Digital Multiplex*
- **F16v3** - *A popular controller used to control lights*
- **FPP / Falcon Player** - *A piece of software that runs on a Raspberry Pi which can control a show and play sequences at preset times*
- **IP54 (or better) -** *The level of water resistance something has (be careful when buying from less trusted retailers as they put that on everything)*
- **Mapping -** *The process of taking a sequence and modifying it to your layout*
- **P5 / P10 -** *Types of high density panels (the number indicates the mm distance between the LEDs)*
- **Panel Daddy** - *Greg Macaree, expert in all things panels and FPP (among many other things)*
- **Pigtails -** *The things in the end of a cable to allow them to hook up to another*
- **Pixels** - *The LEDs that power the show (or lights as normal people would call them)*
- **Power Injection** - *The process of adding additional power to pixels in a longer run (used a lot with mega trees or in the case of 5v, just used a lot)*
- **Raspberry Pi** - *A tiny computer with more computing power than what launched the first space shuttle to the moon that we use to manage twinkly lights on our house*
- **RGB -** Red, Green, Blue - *A Pixel actually consists of three individual LEDS one red, one green and one blue and the intensity of each is what gives the colour, the RGB value is the intensity level for each of the individual LEDS within*
- **Show -** the entire thing from first pixel on to the last song is known as 'the show'
- **Singing face** - a type of prop where the mouth moves to the lyrics of the song
- **Square -** *A type of pixel*
- **Strip -** *A type of pixel (friends don't let friends use strip, unless it's for arches)*
- **Uncle xLights -** *Ron Howard, our American import and king of sequences.*
- **XLights -** the software used to power most of the light shows in the E.L.F. Group
- **WS2811 / WS2812b -** These are the individual addressable LEDs we call a pixel

How to get started

So you've decided to join our Christmas light hobby and have a light display on your house (or apartment, shed or car).
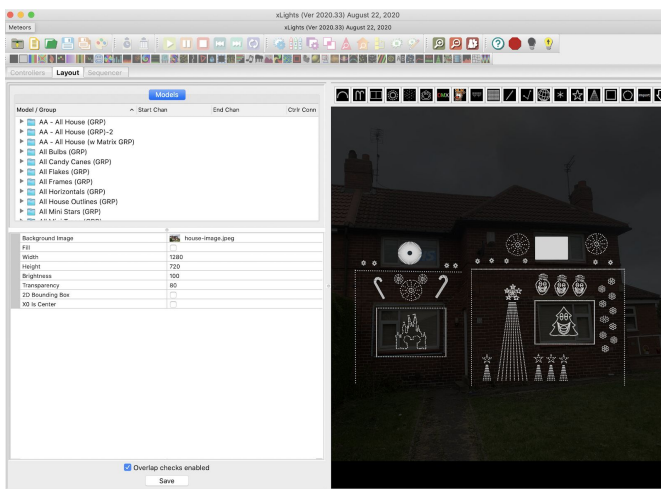
Before jumping head first in, E.L.F has a fantastic resource of videos from some of our experts in the group, they are the perfect way to get an introduction into the terminology, techniques and basics that you need to get a show going.

Then, it's about looking at how much time there is until Christmas and how much time (and money) you can dedicate to the hobby, it's not a joke that many in the group have been working on THIS christmas since February so if you are reading this at the end of October, you might find it easier and less stressful to look at next year rather than this.

Once you've watched the videos, got permission from your spouse and put together a budget (both money and time!) then you are ready to get started!

A general display consists of two elements, the Layout and the sequence, with the effort required for both of these they could almost be considered two separate hobbies in themselves.

Layout

The layout and building of your lights is what most would consider the 'bulk' of the work, depending on the level of complexity.

Stand where you audience will stand and take a photo of where the display will be, then you can import that into your light display software and start placing where the lights will be.
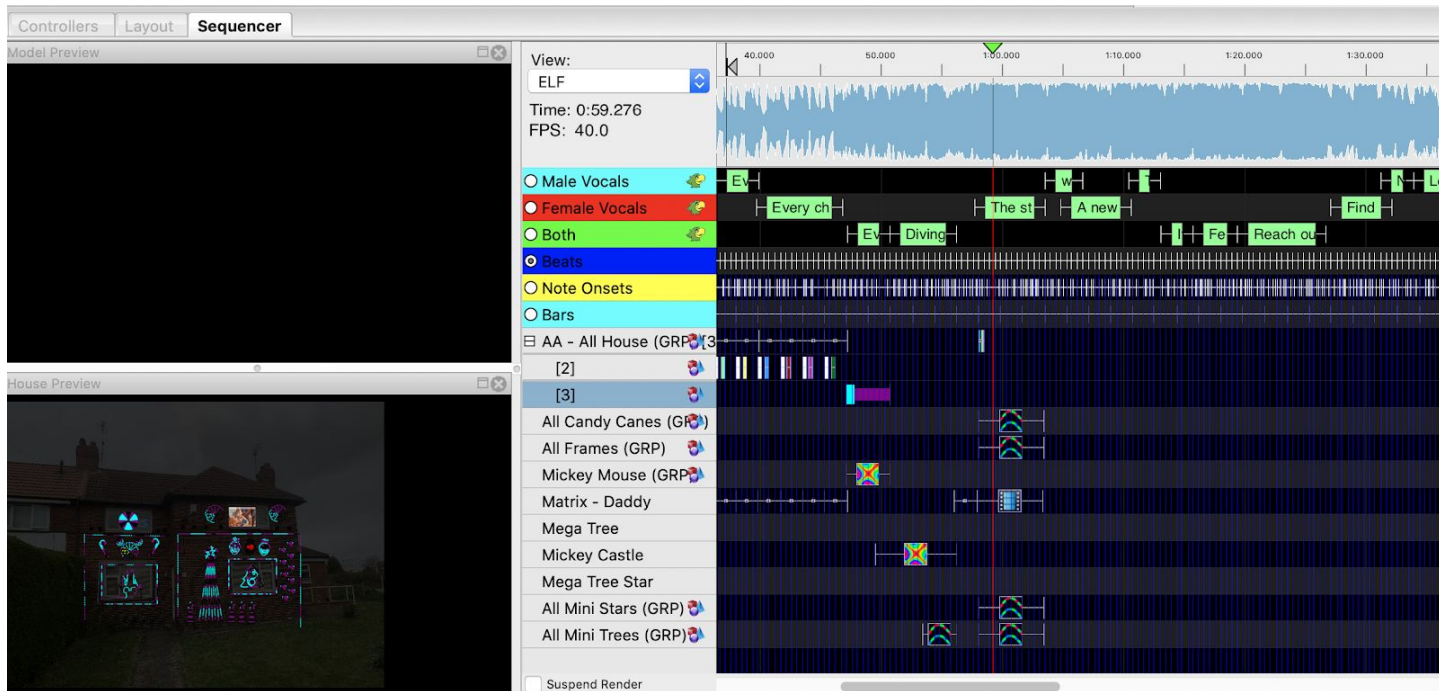
(The E.L.F. group almost exclusively uses xLights but others are available)

Lights are generally grouped into lines, props and trees;

- Lines can be put around the house and windows for a fantastic effect
- Props shapes that are generally made of corex and lights are pushed through to give a certain shape such as a star, bulb, tree or arches
- Trees are a group of lines with a star on top, depending on the amount of lines and lights with enough lights and lines, you've got yourself a MEGA TREE

Once you've decided on your layout, it's time to start ordering and building!

Sequence

A sequence is the thing that makes the lights do pretty colours! A sequence ranges from some nice simple effects that just change the colours to fully time coded shows with music, singing elements and DMX fun stuff.

Before you get too excited / overwhelmed once again, the vast majority of people who see your show will be impressed at the simplest effect.
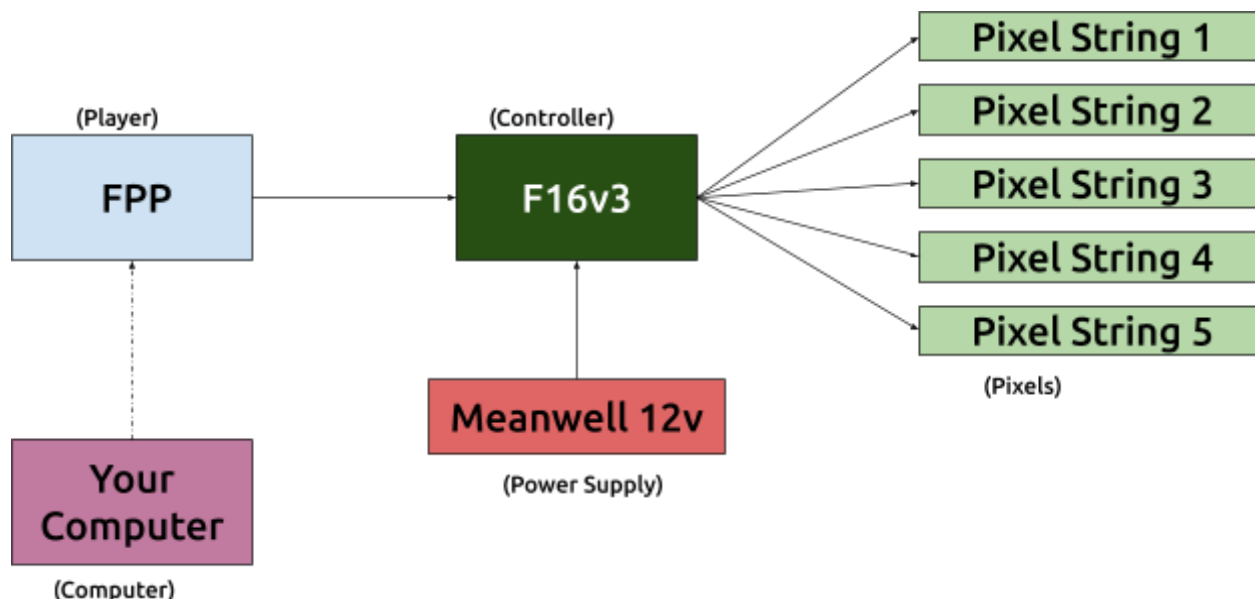
Many people in the hobby do no sequencing at all, they buy sequences (or use free ones) and map them onto their own layout, never feel that there is something wrong with this, it takes a certain type of person to be able to sequence well and also, a lot of people simply don't enjoy it.

Even if you are using other peoples sequences, it's important to understand the basics of sequencing and how things work and can be configured (no sequence is going to map perfectly into your layout without some poking and tweaking)

Hardware Basics

There can be a lot of hardware involved in this hobby, in this section we are going to discuss a typical setup and look at what each thing does and why it's needed.

This is probably NOT how yours will end up looking so don't get too stressed if this looks overly complicated.

Controller

At the heart of every light show is a controller, something to tell the lights to turn on and off. There are lots to choose from and so it all comes down to a) what your plans for the show are and b) what budget you have, below we've listed a few controllers and some of the pros and cons to give you a bit of an idea

Controller Name	Rough Price	Pros	Cons
Falcon F16v3	£200	16 ports - Used by a lot of people - Battle tested in the field - Up to 1000 pixels per port - Can be expanded to 48 Ports (Overall total remains at 16,384)	Not a cheap board to start with (but the most cost effective in the long term)
Falcon F48	£200	- Up to 48 ports - Requires Smart Receivers to connect pixels.	

RaspberryPi + Pi Cap	£34 + Pi	● 2 Ports ● Up to 800 Pixels per port	
ESPArtStick	£30	● Cheap introduction to the hobby ● Good tester	● 1 Port ● Requires SOME soldering

Player

The player is software which will automatically play the show according to either a schedule, manual command or button press.

Here we have a Pi running FPP listed but you could use an old laptop running xSchedule or something similar, the key is that it should be something that during show time is dedicated to that task.

Your Computer

If the controller is doing all the pixels and the player is telling the controller what to do then you shouldn't need a fast laptop to do a light show right?

Well, it depends how complicated your light show is going to be, when you add thousands of lights with lots of effects that are a lot of maths (I can call it maths because this isn't an american document) that your computer has to do and some if is pretty complicated! So doing this on a [Time Machine](#) might not be your best option

On and xLights works on Mac and PC but we'd recommend either a dual monitor or large monitor setup for sequencing!

Power Supply

Your controller will need a pretty decent power supply to be able to power itself and the pixels, you may be tempted to buy a cheap one off eBay but for the sake of £20 extra quid, isn't it worth buying a named brand power supply with inbuilt circuit breakers to protect the show that you've spent lots of time and money on? People have smoked controllers and panels with cheap PSU's, so be warned. Meanwell PSU's (Power Supply Units) are highly recommended as they have inbuilt over-voltage, overload and temperature protection.

Pixels

There are three common types of pixel that you'll see discussed on the group
- Bullet
- Square
- Strip

These pixels typically come in two voltages 5v and 12v, there is always a debate over which ones are better but it's not a debate, 12v is better. Whilst 5v is cheaper per pixel it requires additional spend, on distribution boards, cable and also the invaluable commodity - time.

As with everything, they all have their pros and cons.

Audio Output

If you are using a sequence with a sound-track, you will also need a way to play the music to your audience.

For those using a Pi as their Show Player many find that a usb sound card gives better quality output compared to the on board audio jack.

To output your sound you can either use an amplifier with speakers or a transmitter to output the audio via an unused FM radio channel so your audience can tune in and hear the music.

IMPORTANT: At time of writing, in the United Kingdom the only legal FM transmitters that do not require a licence are CE approved low powered units designed for in car use. These are meant to have a range of only a few metres, but many people find they will actually go further and have enough range for their shows. In the UK if you use a more powerful transmitters you will be breaking the law unless you obtain a Short-term restricted service licence to broadcast, details are at Ofcom

Avoid using Bluetooth transmitters as the audio delay varies and you will not be able to sync it to your light show.

This information applies specifically to the UK and is intended as guidance only. You should always check the current laws and regulations that apply to your country.

Software Basics

xLights

Download from https://xlights.org/

You should also get the QM Vamp Plugin for audio analysis
- Windows - https://xlights.org/downloads/Vamp_Plugin64.exe
- Mac - http://dankulp.com/xlights/qm-vamp-plugins-1.7.1.dmg

Related Training Videos
- #1, #2, #3, #6, #7, #8

FPP - Falcon Player

Download from https://github.com/FalconChristmas/fpp/releases
For flashing your SD card, we recommend - https://www.balena.io/etcher/

Related Training Videos
- #14, #20, #22

Other Considerations

Music Licensing

The E.L.F Group has contacted the PRS/PPL for official confirmation that a licence is not needed for a display on your HOME PREMISES, if you are doing this on a commercial property then a licences may be required, we recommend you call 0800 0720 808

Good morning Dom,

Thank you for your call this morning. I hope you are keeping well.

As per conversation I can confirm that and Christmas Light display using background music to enhance the display at yours or any of your member's homes would not be licensable from our perspective, and would incur no charges for yourselves.

This is based n the fact that the lights are at your home address, so this is classed a domestic dwelling, therefore unlicensable.

I hope this answers your query, and confirms our conversation this morning.

Kindest regards,
Nina.

Nina Bradley
SME Music Licensing Adviser
New Business Music Licensing
T 0800 086 8820
E Nina.Bradley@pplprs.co.uk

If you are not in the UK you must check the requirements from your own country's Music Licensing organisation.

Training Video Archive

Sometimes we record our weekly training sessions and add them to the archive, these are almost ESSENTIAL viewing for anyone wanting to get a head start into the hobby.

The password for these videos is *EUTraining*

Please note that xLights changes all the time and many of these videos we recorded in early 2020 so if something has changed and you are confused, either post in the group or pop into the Thursday training session

#1 - Introduction and Quick Overview - https://vimeo.com/384046376
Ron gives a whirlwind intro into the Hobby, some basic xLights configuration and how to get started

#2 - Layouts in xLights - https://vimeo.com/385557735
Ron takes a simple house and shows how he adds the props to the layout, naming props and grouping.

#3 - xLights Model Assignments - https://vimeo.com/387054943
Ron shows us how to assign ports and channels to individual props 'his way' which is the proper way of course

#4 - The Basics of Mega Trees - https://vimeo.com/390033693

#5 - Wires, Soldering and Crimping - https://vimeo.com/393471647
James takes us through the basics of soldering props, what to do and what not and some tips and tricks for fixing stuff in a pinch.

#6 - What's New in xLights 2020.6 - https://vimeo.com/394993596
With software that updates every few days, it's important to have a recap occasionally on some of the new features (and bugs) added

#7 - xLights 3D - https://vimeo.com/396177894
If you've got props on the side of your house, in your garden or even on a sloped roof, you might want to consider a 3D Model of your house in xLights, this video will give you a good grounding

#8 - Introduction to Panels - https://vimeo.com/400745579
We welcome the Panel Daddy himself to give an overview of everything Panel, P5 / P10, Colorlight, Beagleboard and Pi, a must view video for anyone wanting panel advice

#9 - Custom and Submodels in xLights - https://vimeo.com/402662455
Adding a prop is one thing, but adding submodels and grouping them can take an effect to the next level and as video this shows you, it's not that hard.

#10 - Your questions answered - https://vimeo.com/410337096
Questions including Power Management, File Management, Software Usage and when to update!

#11 - What's New in xLights (again) - https://vimeo.com/410341926
They just won't stop updating this software! Watch this to keep up to date with what has been added to xLights from 5 videos ago!

#12 - Advanced xLights (Groups, Effects, Submodels) - https://vimeo.com/412845904
Once you've watched the introduction to Submodels video, try this one for a little extra knowledge

#13 - 2D Paths, Value Curves and Bulk Edit - https://vimeo.com/416447999
Another must see for anyone wanting to get their grips around sequencing, these tips and tricks will make you a faster and better sequencer

#14 - Scheduling your show with a Pi (or xSchedule) - https://vimeo.com/418204704
Once you've got your layout built and sequence sorted, now you need to start your show!

#15 - Singing Faces - https://vimeo.com/423447184
Nothing brings a show more to life than singing faces (or maybe Pyro but that's a different video)

#16 - Incorporating Pyro to your Display - https://vimeo.com/425583124
See, I told you

#17 - Animation, Storylines and GIFs - https://vimeo.com/426326232
Bring life and art to your display by integrating a storyline and bringing something a little different

#18 - Sequence Mapping - https://vimeo.com/429766574
When you've bought (or downloaded) a beautiful sequence from somewhere, how do you put it onto your house? This video tells you how.

#19 - Networking Basics - https://vimeo.com/445033801
An Introduction to networking, terminology and hardware

#20 - Introduction to FPP - https://vimeo.com/436613902
FPP is a great way to manage your show schedule

#21 - The Human Element - https://vimeo.com/434104354
Show Legality, Show Security and most importantly, not pissing off the neighbours

#22 - Your shows Network - https://vimeo.com/446946267
The last thing you want is your home internet connection disturbing your show, Greg takes us through the hardware and techniques used to make sure your show runs smoothly

#23 - Your questions answered - https://vimeo.com/451624453
This weeks Questions include Custom Models, Layout Tips, Mapping, and Countdown Effects

Weekly Zoom Training

Every Thursday evening, E.L.F. Has a zoom training calling from 8:15pm (In whatever timezone England is in at the time)

The URL to join the chat is at https://zoom.us/j/636622081

It may ask you to download some software or view the meeting on the website.

There are three types of zoom session currently

1. There will be a set subject for the training where one of our members has a specific thing to talk through
2. There will be a thread posted earlier in the week where people can leave questions or items they'd like to discuss on the call, this forms the basis of an agenda and the group will try and answer the best they can
3. We have no set topic or Agenda and discussions and we have breakout rooms for individual topics and conversations.

Between 8:15 and 8:30 whilst we wait for latecomers to arrive, there tends to be a bit of casual chat between the regulars to catch up, so if this is your first time, don't be afraid to jump in and say Hi (either on voice or the text chat). We don't bite, and it's not as cliquey as it first appears!

Just remember (especially if there are other people in the room) to mute your microphone if you can, generally when someone speaks into the mic it overtakes everyone and you don't want to be chatting to your spouse (or dog, or children, or yourself!) and have the rest of us overhearing in the middle of a training session!

E.L.F Shopping list

Your layout and needs will differ from everyone else's but below are some recommended tools, accessories and other bits that will make your experience a bit easier!

(Some of these will have an affiliate link but the money raised (all 30p of it, will go towards the next E.L.F mini)

Tools

- Soldering Iron - Super Pro Kit 125 - https://amzn.to/352cj8n
  - Gas powered soldering iron, perfect for fixing things up a ladder (also has a blowtorch for heatshrink)
- Soldering Iron Station - https://amzn.to/3i6762Y
  - A good station perfect for a desk or workshop
- Heat Gun - https://amzn.to/3hOk45k
  - Ignore the phallic nature of the product, this heat gun is perfect for solder seat and heatshrink (without being too hot that it burns carpet)
- Wire Snippers - https://s.click.aliexpress.com/e/_dZNeRCg
  - For $2 these simple wire snippers are an easy thing to add to your shopping list and always come in handy!
- 3D Printer - Ender 3 - https://amzn.to/2Fa7SgO
  - You know you want one.
- Wire Stripping Multitool - https://s.click.aliexpress.com/e/_d7EiQ7E
  - Perfect for Coax Cable that wont fit in the other type
- Wire Stripping Pliers - https://amzn.to/32GMfN3
  - A staple in every tool box
- Mini Screwdriver set - https://amzn.to/34M7L5P
  - You would not believe the amount of tiny screws used on controllers and differential boards
- Nanotech multimeter - https://amzn.to/2YTCVEG
  - This cheap and cheerful multimeter has crocodile clips to affix to those pesky tiny lights

Networking

- NETGEAR GS105 - https://amzn.to/3bevVa8
  - As featured in our 'Creating a show network' video training session

Controllers

- Wireless Remote Control - https://amzn.to/3hLSVjp
  - This is perfect for testing a section of lights or running some small strip in a room
- ESP32 - https://s.click.aliexpress.com/e/_dYutqLa
  - These with WLED flashed on can be excellent 5v controllers

Wire and Cable

- 10 Gauge Wire - https://amzn.to/32FyPAZ
    - Perfect for the power supply to the controller
- 6mm Heatshink - https://amzn.to/34QcPG4
    - This should be great for pixels and pigtails
- Solder Seal Bag of 100 - https://bit.ly/3lxjfzT
    - Waterproof your solder and make it a little big stronger with one of these
- Terminal Forks - https://s.click.aliexpress.com/e/_dYoWQhI
    - Perfect for making those power and data connections just a little bit neater
- 4 Way fuse block holder - https://s.click.aliexpress.com/e/_dZ9PYeC
    - Perfect for managing those power supplies
- Cable Holders - https://s.click.aliexpress.com/e/_d8dXKYU
    - These little things will let you affix cable to places with a quick release
- Mini Blade Fuses - https://s.click.aliexpress.com/e/_dW3Bj3q
    - Well you need something to put in your fuse block and controller when you break them
- JST Pigtails - https://bit.ly/2Dk1H9k
    - If you need some extra ones for your indoor props (or you are using JST waterproofing methods)
- Mini Trunking - https://www.toolstation.com/mini-trunking-3m/p12544
    - Perfect for windows and house lines
- Outdoor 3 Core Cable - https://www.toolstation.com/pitacs-weather-resistant-rubber-pond-flex-cable-3183p/p17796?searchstr=flex%20cable%20pond

Panels

- P5 Panel - https://panelsrus.co.uk/products/p5-64x32-indoor-led-panel
- P10 Panel - https://panelsrus.co.uk/products/p10-16x32-indoor-panel
- Colorlight Card - https://panelsrus.co.uk/collections/panel-controllers/products/colorlight-reciever-card

Accessories

- Raspberry Pi Starter Kit https://amzn.to/3hNhrR3 or https://amzn.to/3bk2XWr
    - There are ALWAYS uses for the Pi in lights and whilst the 4 is the latest Model, the 3B+ is cheaper and great for lights.
- Wago Connectors - https://www.aliexpress.com/item/4000193164403.html
    - These are perfect for bridging connections and making test cables
- M2/M3/M4 Screw Set - https://s.click.aliexpress.com/e/_dUpXkPS
    - Panels and many controllers run on M3 Screws so it's always good to have a selection in stock
- 64Gb Micro SD Card - https://amzn.to/3bfYcgp
    - You can never have too many of these for your Pi or other accessories (just double check you buy brand name ones as there tends to be a LOT of dodgy knock offs)

- Creative Sound Blaster Play:3 - https://amzn.to/2QIOsSI
  - What? You want SOUND on your synchronized to music show?
- A Mouse - https://amzn.to/3bcX4dC
  - You WANT a mouse, don't try and do this with a trackpad.

Member Showcase

Member	Song	URL
Finn Hoenigmann	Greatest Showman	https://www.youtube.com/watch?v=8U1AO9Xbo3k
George Farley	We wish you a Merry Christmas	https://www.youtube.com/watch?v=0-jq5fS5xQg
Dave Freeman	Dueling Banjos	https://www.youtube.com/watch?v=27VOTHdNSGU
James Innes	Feel the Love	https://vimeo.com/312175989
James Innes	Let It Go	https://vimeo.com/381361797
Dave Freeman	I Wish it could be Christmas everyday	https://www.youtube.com/watch?v=lZ0dFpCntmk
Vegard Rødland Vetnes	Paw Patrol Theme	https://www.youtube.com/watch?v=l950C-v3SR4
Vegard Rødland Vetnes	Little Drummer Boy	https://www.youtube.com/watch?v=a3L1jXx5dxc
Stuart Milton	Hello Neighbour	https://vimeo.com/453361443
Stuart Milton	That one from Home Alone	https://vimeo.com/305307325
John Fullegar	Dominick The Donkey	https://www.youtube.com/watch?v=uUQKX93H_KA
John Fullegar	I want a hippopotamus for Christmas	https://www.youtube.com/watch?v=jyzR0hEi2XY
Rik Burt	The Prodigy Mix	https://www.youtube.com/watch?v=YnLSbb3pLFk
Panel Daddy	Jingle Bells	https://vimeo.com/378288156
Scott Jordan	Dance Monkey	https://www.youtube.com/watch?v=pkgt6u5Slgs
Scott Jordan	Hey, come look at my lights	https://www.youtube.com/watch?v=HkutFjrppOo
Nathan Mills	Feed the World (do they know it's christmas)	https://www.facebook.com/watch/?v=585646608934567
Stephen Audsley	Christmas Medley	https://www.facebook.com/watch/?v=523213918283760

Martin Penney	Let It Snow	https://www.youtube.com/watch?v=XNtbWkUv_vA&feature=youtu.be

Featured Suppliers

These recommended companies are owned by members actually in the group who provide advice above and beyond what you'd normally class as 'customer service' so to reward them, we've given them a teeny tiny mention right at the bottom of the document.

Build a Light Show - https://buildalightshow.com/

Panelsrus - https://panelsrus.co.uk/

Xtreme Sequences - https://www.xtremesequences.com/

Guide Contributors

- Dom Hodgson
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