



3X

10 TIPS

to understanding
laser display systems

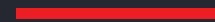
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10 TIPS

to understanding modern lasers
used for the entertainment
industry



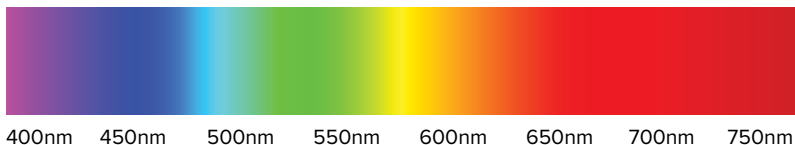
01:

What is a LASER?

The laser is a **bunch of energy waves** (streams of photons called radiation) with the same amplitude and phase that are flowing the same direction, meaning they are coherent - they stick together and form a laser beam.

The width of a single wave is measured in nanometers and defines the colour and visibility of the laser beam.

Visible spectrum of light (400 - 700nm):



02:

What makes the beam visible?

Mainly it is the **particles of dust and water in the air** that the laser beam hits on its path. That's why we "laserists" use haze or smoke machines to make lasers more visible. Too much of the haze or smoke will kill it, but the right amount will make all the difference between no show and a great show.

When outdoors, lasers mainly reflect off dust and mist in the air but due to unpredictable wind conditions we can never make sure the hazers or smoke machines will be effective enough. And that's why we use high power lasers for outdoor shows - to substitute for the lack of dust, haze and smoke.

03:

How far does it go and can it get to the Moon?

Depending on the power output of the system and weather conditions, **the laser can be visible for miles** - that is why we need to be cautious about aircrafts when performing outdoor shows.

And if you get a system that is powerful enough then **YES, it can reach the Moon.**

04:

How the colours work?

Standard full colour analogue lasers use three primary colours: **Red, Green and Blue**. By mixing those together you can pretty much get any secondary colour.

Red + Blue = Magenta

Red + Green = Yellow

Green + Blue = Cyan

Red + Green + Blue = White

Of course the number and precision of the colours is determined by stability and linearity of the modulation of the system. If the system is not stable enough, it will produce different colours every time making it virtually impossible to match the colours of two systems at one time - there are tons of these on the market so be careful.

05:

How do I recognise a quality laser?

You won't unless you are experienced.

We recommend you to **do some research**. The online forums and other people's references are probably the best for that. In general, the laser market is one of those where you get what you pay for and there's no way around it.

The quality will always cost you fair bit of money, but even then you need to make sure you are getting the quality you pay for.



Clubmax 3000 FB4



Spectrum 33 RGBY

06:

Main factors that determine the quality

Laser source technology and quality of build – Anyone can bolt some components together, but building a quality and long lasting laser takes a lot of precision and that's the issue here.

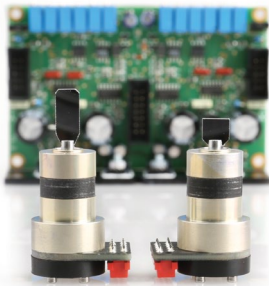
It is quite likely though that long established manufacturers who do have facilities for their own development and manufacturing will do their job well. We recommend you to be careful though. Some companies are only in it for the money, whilst **we do it because we love lasers** and that helps us to be better.

Size of beam and divergence – The smaller and tighter the beam is over a distance, the better visibility and concentrated power you will get.

Also **matching beam sizes and beam profiles** of all the colours are very important when it comes to full colour lasers.

07:

What is a modern laser system made of?



Scanning system

Enclosure - these days it can get pretty sophisticated and IP rated with many clever and useful features for touring and dry hiring.

Laser source - quality laser modules are essential for reliable and decent performance as well as a long life span of the system.

Scanning system - the scanning speed and precision determines the graphical performance of the system.

PSU - if this fails, everything else fails too. KVANT uses only high quality power supplies with very low failure rates.

Driving Electronics - there's a great deal of development going into the driving electronics as the laser modules performance heavily depends on the quality of its driver board and temperature stabilization technology.

Safety Features - these are firmly established by law, but very often ignored. Make sure your system is up to date and legal to use otherwise you are risking a lot!

Optical components - non quality optics can get damaged by the heat of the laser source; this in turn will cause great losses in power and/or misalignments.

Connectors, Cables, Fuses, bits and pieces - every one of these are absolutely critical. What difference will a good quality laser make if you use poor quality signal cables? NONE.

08:

Scanning system, how it works?

A scanning system is essentially two **tiny mirrors, each moving the laser beam on X or Y axis**. By working together they can “scan” the laser beam into any forward direction. Once a shape is scanned more than 20 times per second it appears static to human eye.

So any shape drawn by a laser is actually produced by one single laser beam running around like crazy. Every scanning system has a mechanical limit of how many points it can display at any one time and that is usually represented in Points Per Second (pps).

Tunnel effect explained: if you make a single beam form a circle at a fast enough pace, you will see a static circle on the wall. However, when you turn around to face the laser you will stand in a tunnel of light.

09:

ILDA and 3D laser?

ILDA is an acronym for International Laser Display Association, but it also represents standardized laser signal protocol used by the majority of laser manufacturers.

The fact that a laser is ILDA compatible (meaning you can control it from any ILDA compatible control system) **does not** give you any quality assurance at all. Even the cheapest and worst lasers can be “ILDA”.

3D lasers are bit of a myth and just part of marketing tricks. Any laser can create 3rd dimension by projecting into a space. Lasers can have various additional effects mounted in for different purposes, but those have hardly anything to do with 3D projection.

10:

Control systems

There are plenty of control systems on the market to choose from and the overall performance of a laser system is heavily dependant on quality of the control system you use, so don't hesitate to invest a fair amount of money into it.



*Kvant FB4 Stand-alone
Control Interface*



10 TIPS

for choosing the right
laser system

11:

Don't judge a laser by its model number.

Unlike KVANT, many manufacturers use numbers in their product names, but these don't always correspond to the actual power output of the product.

A '6000' model designation doesn't necessarily mean that the laser you're looking at produces 6 Watts of laser light.

So that you know what you are paying for, always remember to check the **minimal guaranteed** power output of the system.

SOMETIMES LESS REALLY IS MORE.

12:

Scanning speeds can be deceptive.

The speed of the scanning system is measured in points per second (pps), **normally at a 7-8 degrees** scanning angle, i.e. **30.000pps@8** degrees. And this could be sometimes interpreted as **60.000pps@4** degrees or **100.000pps@2** degrees.

The fastest scanning system we currently know has a maximum scanning speed of about 90.000pps@7 degrees.

ALWAYS CONSIDER THE ANGLE AT WHICH THE SPEED WAS MEASURED.

13:

How much power do I need?

Each milliwatt of quality laser power is relatively expensive so **don't waste** money buying more power than you need.

Equally don't under specify - that's actually the worst thing you could do. The main factor here is the quality of the beam. The tighter and smaller the beam, less power is needed.

Here's a **general power guide** based on good beam quality using our KVANT lasers when conditions are ideal:

- Small indoor venue - up to 1500 people: **500mW - 2000mW**
- Medium indoor venue - up to 3000 people: **2000 - 6000mW**
- Large indoor venue - 5000 people or more: **6000mW - 10W**
- Medium size event, open air stage, small festival: **10 - 20W**
- Large outdoor events, festivals and stadiums: **20W & upwards**

14:

Do I need full or single colour laser?

Green lasers are highly visible and reach further than any other colour laser beam at the same power, so green lasers can be a great option for large outdoor events and long distance advertising.

For everything else full colour lasers are most versatile and give the best audience experience. So for 95% of applications you'll want a full colour system.

**WE SUPPLY AND HIRE ALL TYPES
OF KVANT LASERS.**

15:

Manufacturer vs. Importer/Assembler

There are many importers and assemblers who call themselves manufacturers. The reality is that you could be paying big money for cheap and low quality re-branded imports.

**WE DEVELOP, DESIGN & MANUFACTURE EVERY
KVANT LASER IN-HOUSE.**



Rear panel
(Spectrum 2018)

16:

Europe, China or elsewhere?

If you are serious about lasers and if it is important to you that you can rely on your equipment, then lasers from the Far East are not exactly what you are after. The cost of any repairs due to high shipping costs and delays can easily cancel out the initial money saved. Also your reputation could be at stake.

YOU GET WHAT YOU PAY FOR.

17:

How much should I spend?

High quality, low power laser systems will cost anywhere between £1000 to £5000. The biggest can be even over £100k.

Quite often the middle ground is the correct option and when it comes to the cost of lasers we are exactly there.

And whatever size laser you need there's a competitively priced KVANT laser that's made for the job.

DON'T UNDERPAY. DON'T OVERPAY.



18:

What about life span?

You may save some money initially on a cheaper laser where some of the colours are based on older DPSS technology or Diode technology of lower quality.

When we say older DPSS, we don't mean all DPSS. There are superb quality DPSS modules round, but they cost thousands and normally you won't find them in show laser systems.

Many Far East manufacturers specify a 10.000h life expectancy for DPSS and Diode laser modules and while this might be true in rare cases, we have never experienced even 300 hours when testing them.

REPAIRS ARE COSTLY AND COMPLICATED.

19:

And what about laser safety?

You would not want to get in trouble with authorities or harm someone's eye sight. Make sure the laser you get fulfils all european safety requirements. And not only on data sheet.

Make sure you get all necessary accessories and knowledge to do your shows lawfully and with minimal risk.

IF YOU DO IT, PLEASE DO IT RIGHT!



KVANT[®]

20:

Control capabilities

Light-to-Sound AUTO mode is not the right way to do safe and quality shows. Make sure the system you are getting is at least ILDA compatible for better control.

These days most KVANT laser display systems come with Ethernet and DMX/Artnet control options as standard.

**PROPER CONTROL MAKES LASERS
LOOK SO MUCH NICER.**

*KVANT FB4
Quick Connect Control
Interface*



www.kvantlasers.sk



10 TIPS

for safer laser displays

21:

How important is laser safety?

Maintaining laser safety should be the most important aspect of any laser show presentation. Lasers can create very impressive effects but it is important that those effects remain safe throughout the presentation.

If you fail due to an aspect of your laser show production, the only thing affected is your credibility and maybe your wallet.

If you fail in laser safety, the consequence can be more serious with the potential of causing somebody a permanent **eye injury**.



Laser safety goggles

22:

Why are lasers dangerous?

The laser light is **coherent** meaning that all the energy travels in the same direction and phase; unlike sunlight or light from a light bulb.

This enables laser light to remain **concentrated** over long distances, which is what makes it look so impressive for lighting effects, but if used without care, laser light can present an exposure risk for direct viewing.

In such instances the human eye has the ability to **focus** this light onto a super-tiny spot on the retina, meaning even just few mW of visible laser light could cause permanent eye injury.

23:

Legal obligations of laser users in Europe

Laser equipment in Europe must conform to the laser product safety standard **EN 60825**, meaning it must be supplied with specific safety features.

Kvant works hard to ensure our laser projectors meet this standard.

Anyone using lasers and exposing others to laser radiation is legally responsible for their actions.

Current European law prohibits exposing others to excessive laser radiation, where excessive means 'over the **Maximum Permissible Exposure (MPE)** limits'.

24:

Basic laser safety terms



Audience Scanning is when laser light or its reflections are directed towards the heads of the audience. An extensive amount of knowledge and experience, together with the right testing equipment is necessary to correctly assess laser safety in order to perform audience scanning safely.

Maximum Permissible Exposure (MPE) is the maximum amount of visible laser radiation considered not to cause harm, for a given exposure time.

In many European countries these exposure limits may also be a legal requirement.

The MPE is 25.4W/m² for a period of 250 milliseconds, which is the equivalent to 1mW over a 7mm circular aperture (the size of the human pupil).

For shorter exposure durations, such as when the beam is scanning fast, and has a suitable scan-fail detector, it is possible to apply higher limits.

Exposure levels above 25.4W/m² are higher risk, so must be used with care and proper understanding of what is still acceptable.

Nominal Ocular Hazard Distance (NOHD) is the distance between you and a laser projector that is considered to be safe if you are hit by a single beam at full power for a period of less than 250ms. Just as an example, the lowest power system that we manufacture is called the **Clubmax 1000** which outputs 1000mW of laser power.

The NOHD even of this small system is for a stationary beam **285m**. Yes, 285 metres!

25:

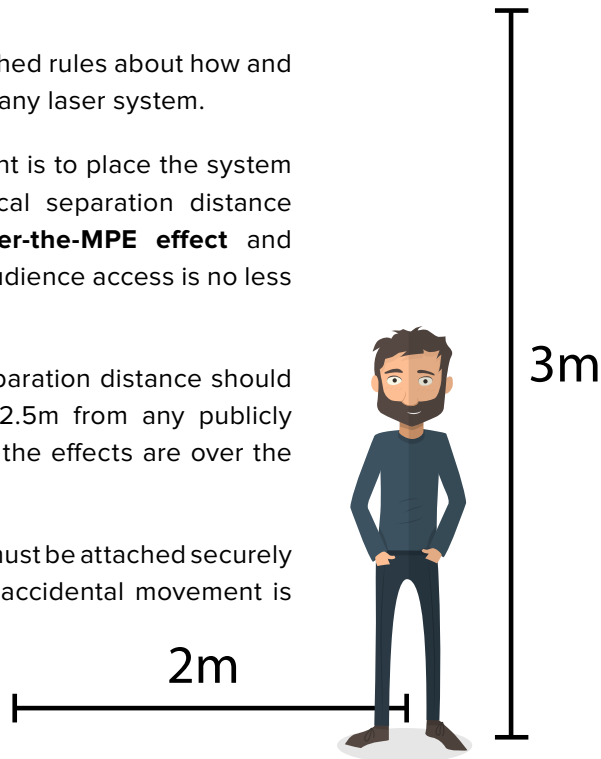
Where to place a laser ?

There are established rules about how and where to position any laser system.

The most important is to place the system so that the vertical separation distance between any **over-the-MPE effect** and highest point of audience access is no less than 3m.

The horizontal separation distance should be no less than 2.5m from any publicly accessible area if the effects are over the MPE.

The laser system must be attached securely in position so no accidental movement is possible.



26:

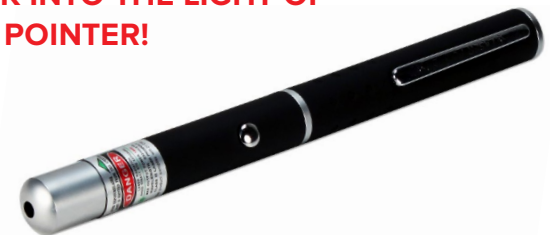
Laser pointers

We all know how **dangerous laser pointers** are when pointed at aircraft.

If the authorities catch you aiming any laser at an **aircraft** you will most likely go to jail, regardless of whether it was only a laser pointer or a big laser system.

Laser pointers are very dangerous in the hands of those who play with them in public thinking it's fun. Many of these pointers produce more than enough power to cause dazzle or **permanent eye injury** to anyone who is quite a long distance away.

NEVER LOOK INTO THE LIGHT OF ANY LASER POINTER!



27:

Laser display safety records

For every event where lasers are used you should prepare a document that covers Laser Safety for that particular installation and/or show production.

This document should be submitted to the venue owner/manager and the local **Laser Safety Officer** (LSO) who should sign it off.

This should demonstrate that everything was done in accordance with the very latest legislation and that what you are planning to do is safe for your audience.

It would also help you if someone ever falsely accused you of causing laser-related damage to people or to property.

28:

SafetyScan lenses

SafetyScan lenses from Pangolin are compatible with all KVANT laser systems.

They increase the divergence of laser beams and thus reduce the power density of the light helping to make audience scanning safer.

Using these lenses does not necessarily mean the show is safe, so make sure you fully understand how they work.

*SafetyScan lens
with attachment
bracket*



29:

How can You help to make your laser show safer?



- A. Understand the problems - go to safety training, search online and learn from others who are competent enough.
- B. Don't scan the audience unless you are 100% certain that what you are doing is 100% safe.
- C. Position the lasers according to basic rules and don't compromise on safety for any reason.
- D. Use physical masking to limit the laser output to areas where the laser beams are not supposed to go.
- E. Use only laser projectors from well known and respectable manufacturers.
- F. Use only projectors that are legal to use in the region where you use them.
- E. Always check for and deal with any reflective surfaces that could direct the beams in any unwanted direction.
- F. Do your homework and always prepare your Laser Display Safety Record and have it signed off.
- G. Read this brochure at least 3 times and keep it safe for future reference.

30:

Laser safety training: Yes or No?

100% YES!

Go for laser safety training provided by an expert in your area. It is money well spent and if the training is as good as the one run by LVR Optical (www.lvroptical.com) in the UK, you will understand all the important basics in no time.



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