

PHILIPS

Introduction to DMX

BU Controls
2008

Objective

- Explain simplified functioning of a DMX control system
- Provide basic technical clarification

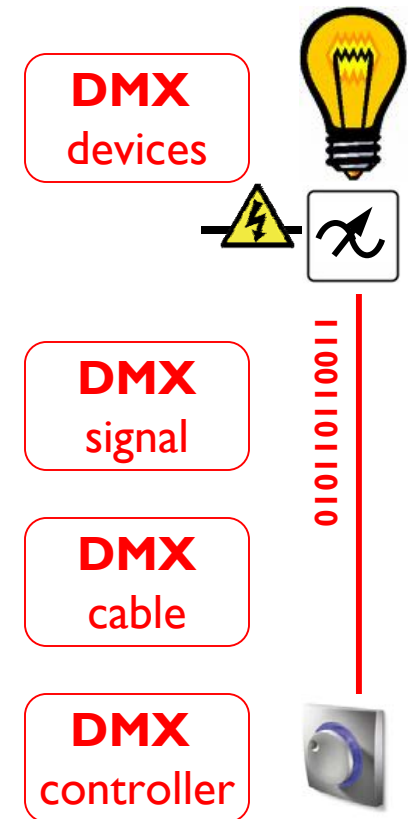
What is DMX

The origin of the abbreviation of DMX is unknown. However it is often explained as Digital Multiplexed signal

It is a protocol, in which a DMX controller communicates to DMX luminaires

In other words

DMX is the language in which DMX controller talks to DMX luminaires



Examples of DMX products



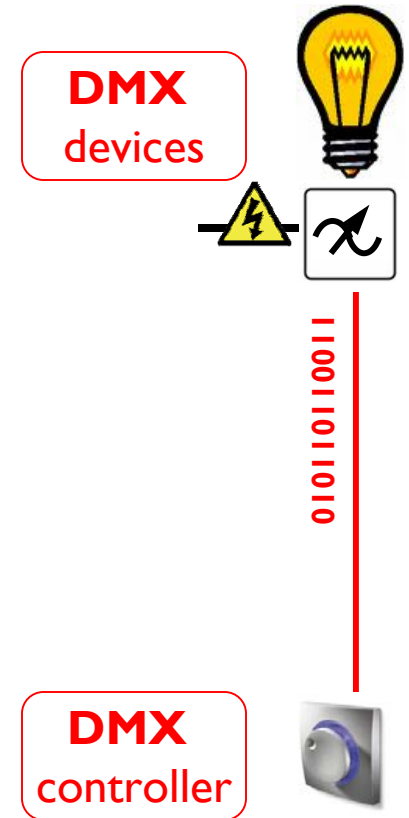
Luminaires



Switchpacks

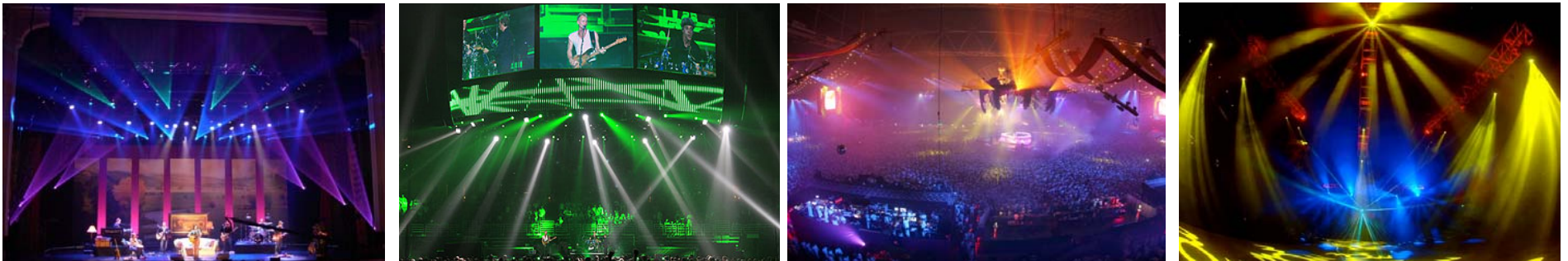


DMX controllers

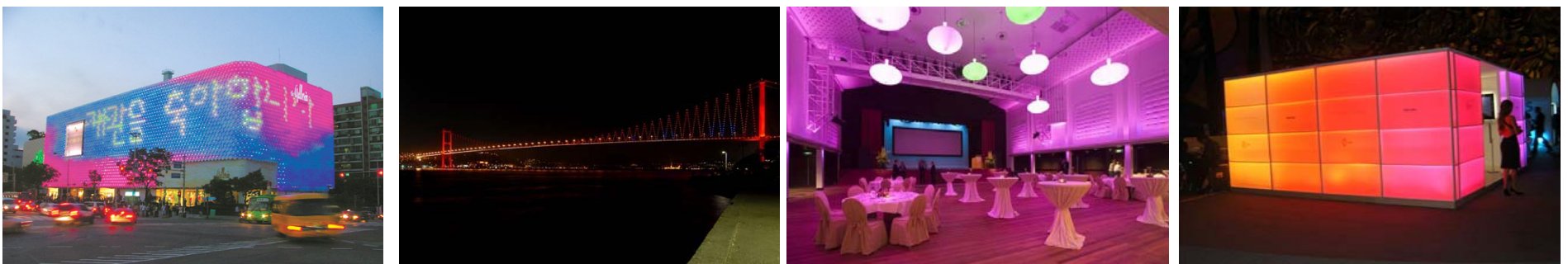


History of DMX

DMX originated in the world of theatre was developed by USITT in 1986. DMX is used mainly for “controlling lighting equipment and accessories” in entertainment applications (theatre, staging, concerts etc)



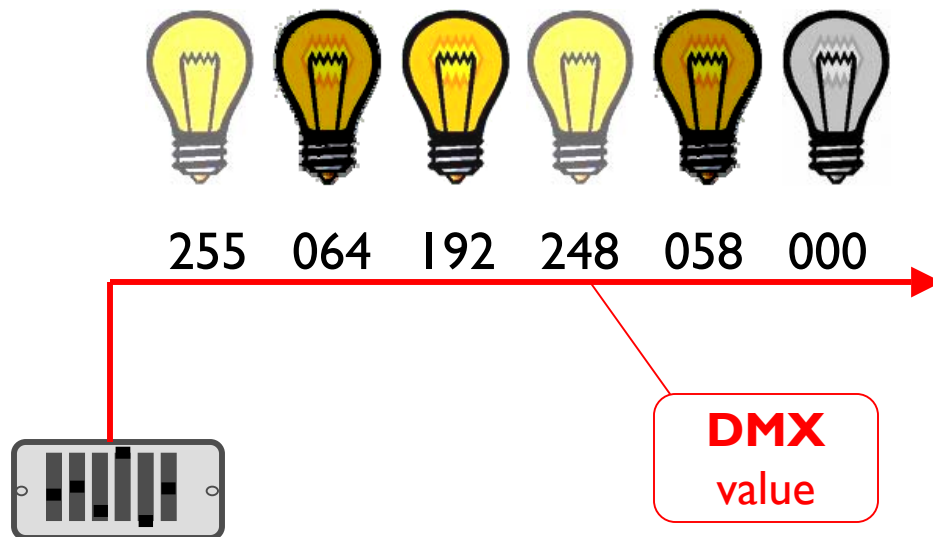
Nowadays DMX is used more and more in architectural scene setting applications as well.








The DMX signal explained

A DMX controller sends DMX values.

This is a 8-bit value (value between 0-255) corresponding to a 0-100% intensity



DMX Value	Intensity
0	0% 
64	25% 
128	50% 
192	75% 
255	100% 

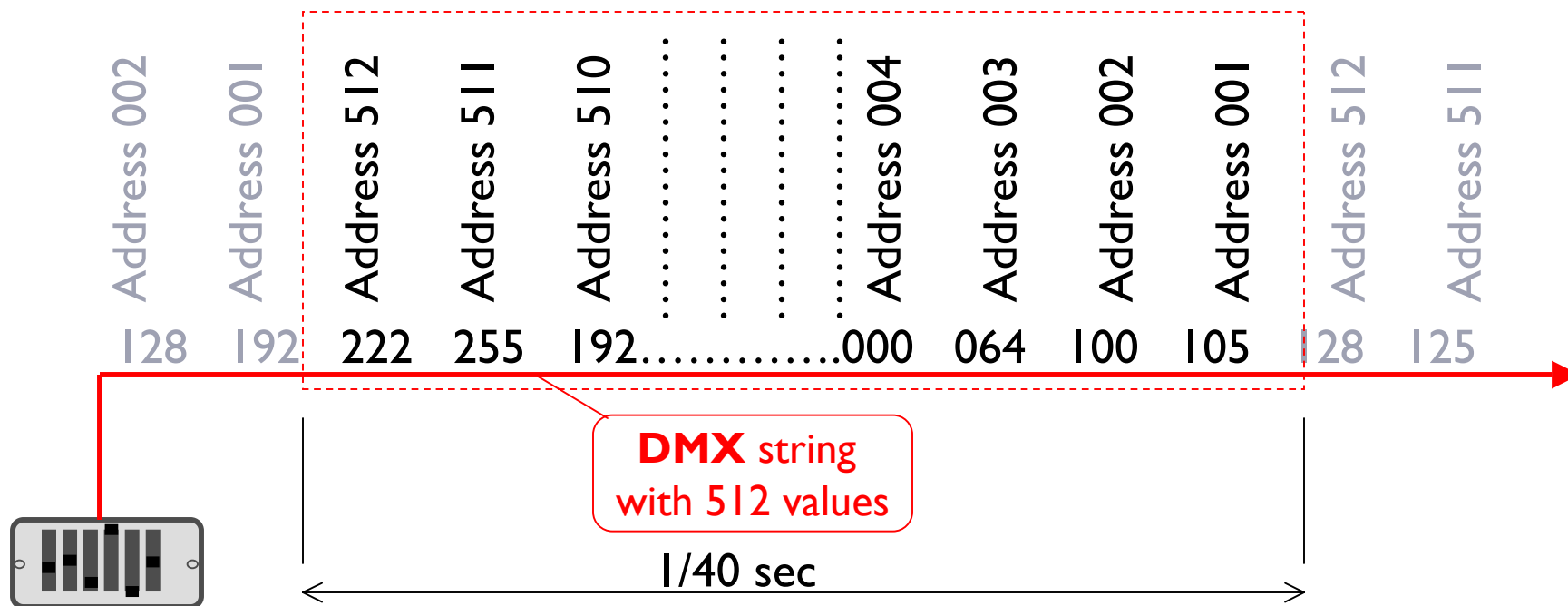
DMX signal



The DMX signal explained

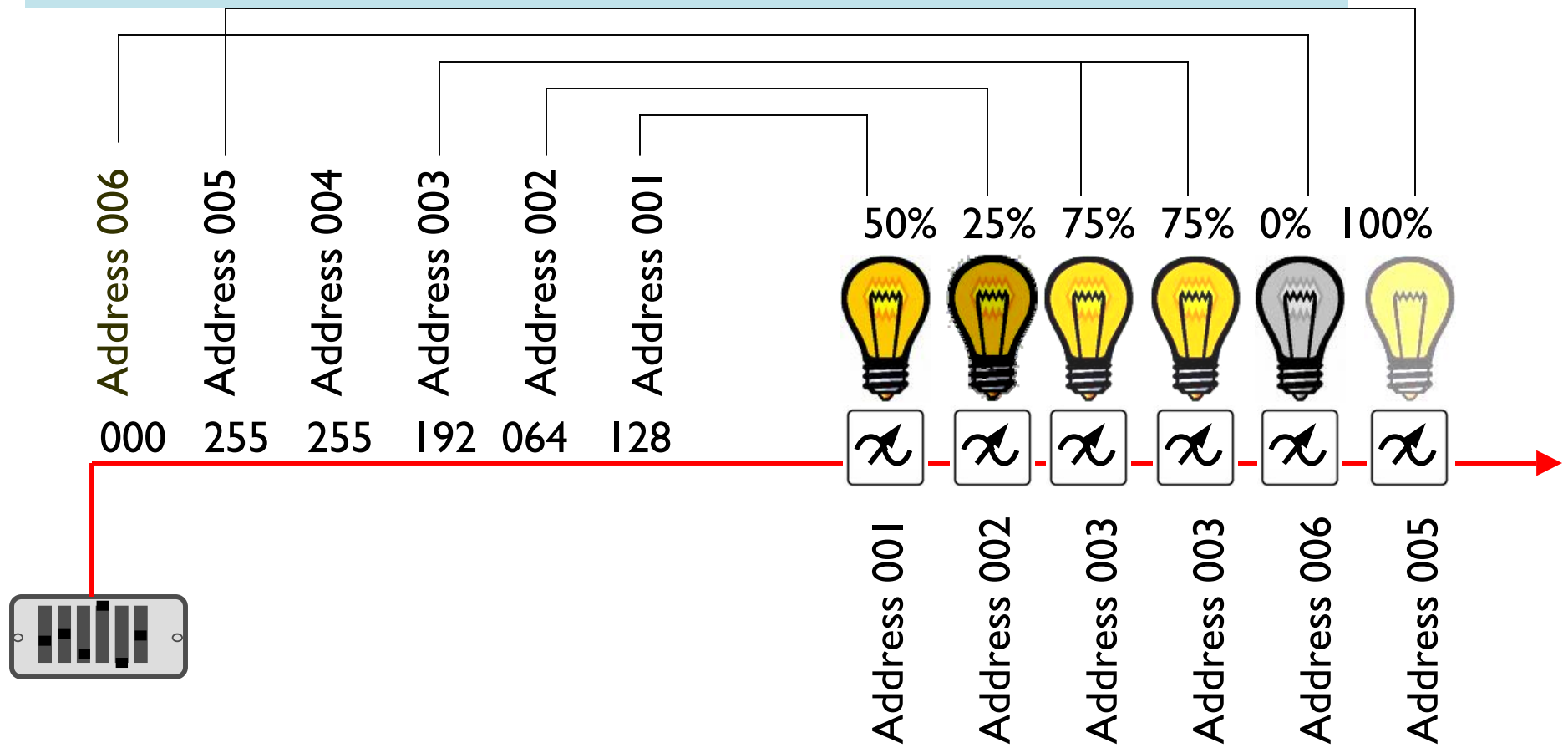
Strings of 512 values are send 40 times per second.

The location of a DMX value is referred to as “address”



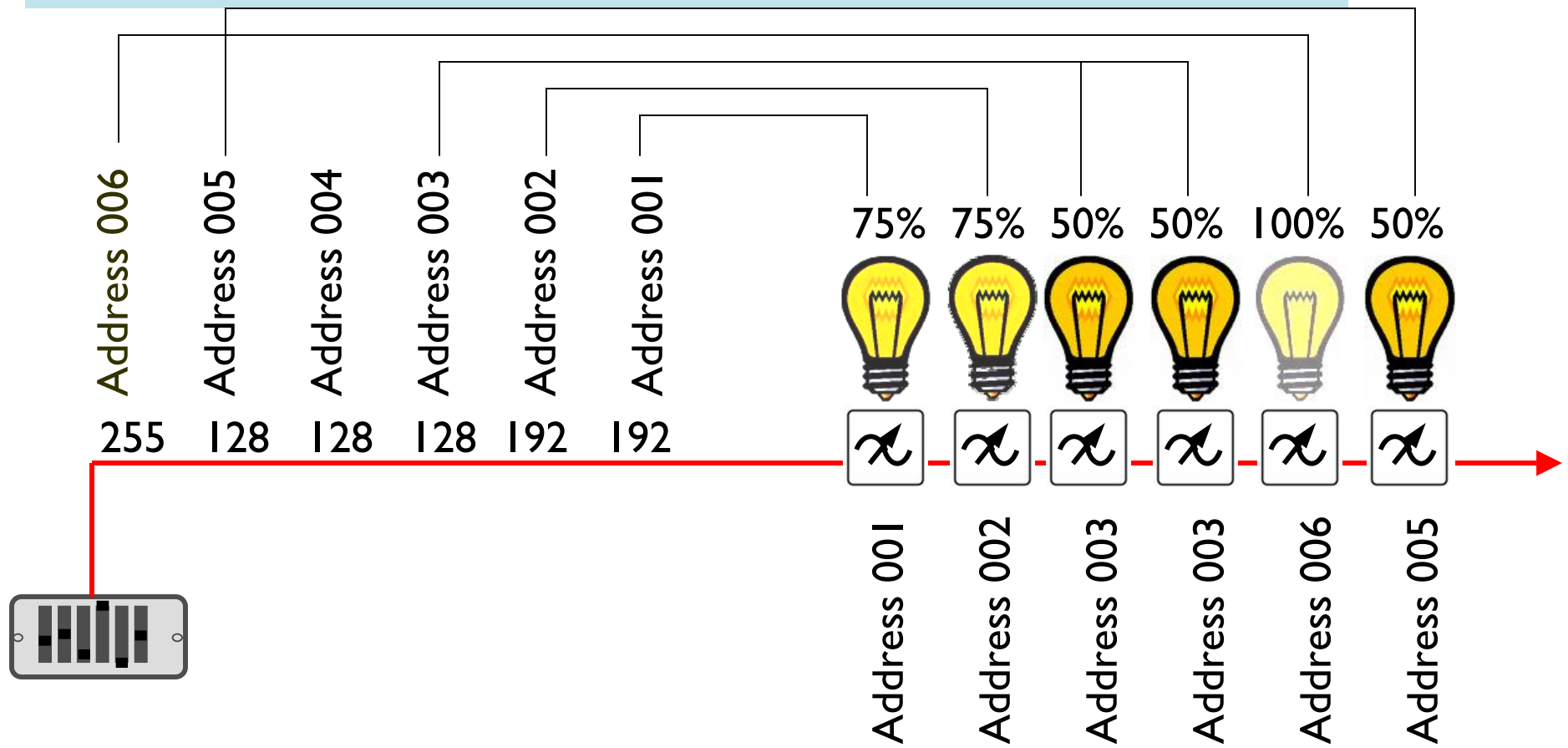
The DMX signal explained

By addressing the DMX device, it knows which DMX value to use



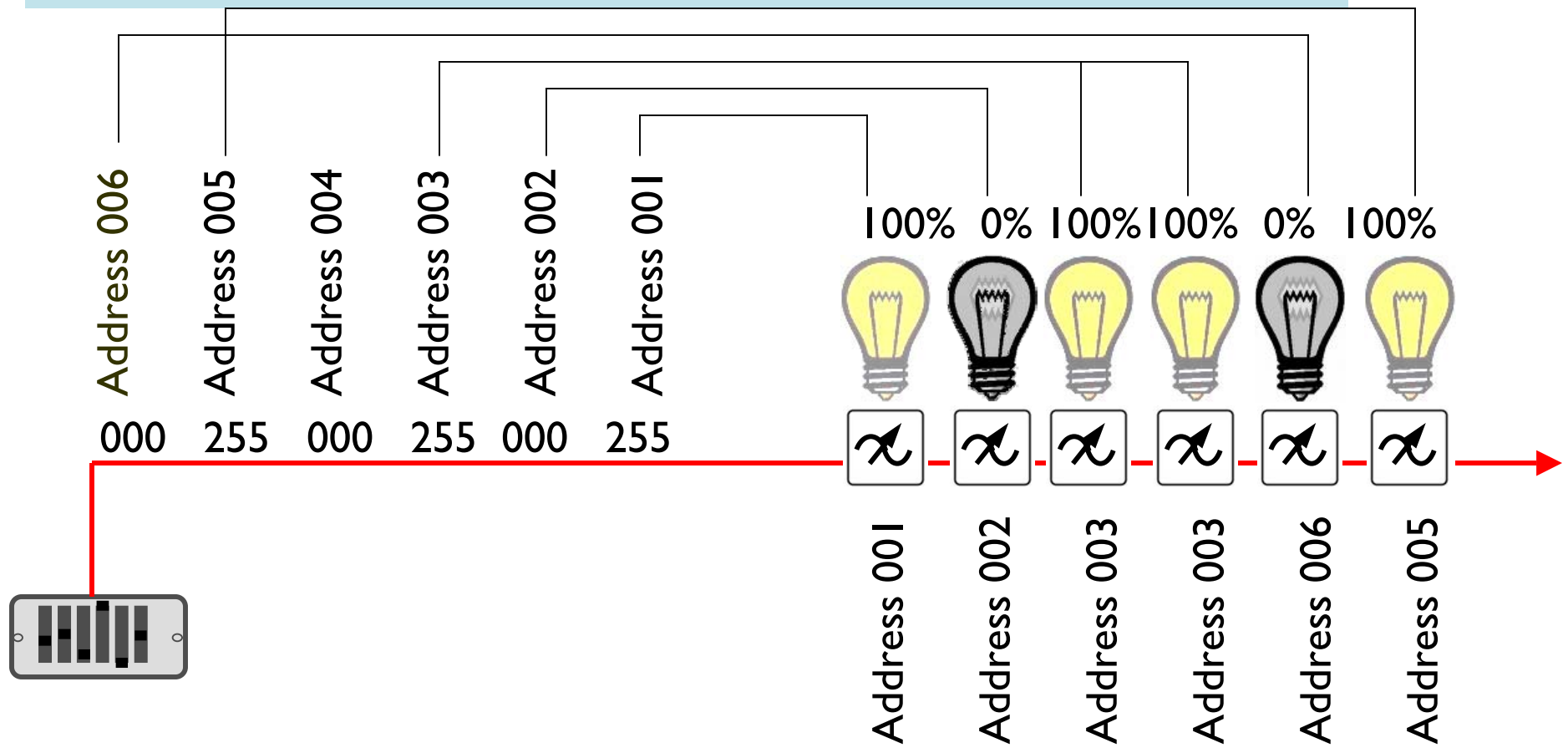
The DMX signal explained

By addressing the DMX device, it knows which DMX value to use



The DMX signal explained

By addressing the DMX device, it knows which DMX value to use



The DMX signal in scene setting

Most DMX devices use more than one DMX-address
 In example, the LED LINE2 uses 3 DMX addresses.

- 1st DMX value determines the intensity of **RED**,
- 2nd DMX value determines the intensity of **GREEN**
- 3rd DMX value determines the intensity of **BLUE**

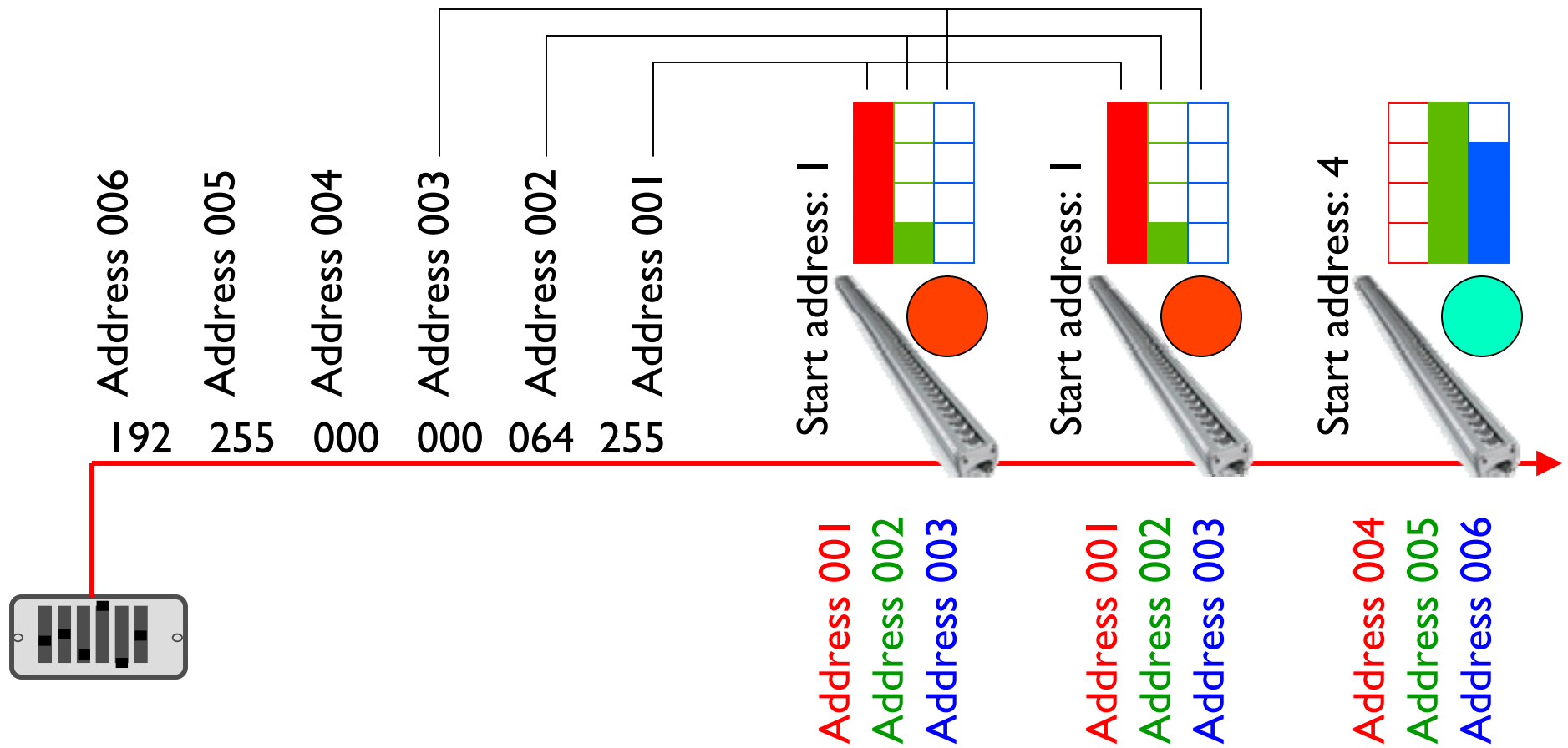


The DMX-start address is the first DMX value used,
 (DMX-start address+1) the second value, etc.

Start address:	1	4	22	215
DMX addr. Red intensity:	1	4	22	215
DMX addr. Green intensity:	2	5	23	216
DMX addr. Blue intensity:	3	6	24	217

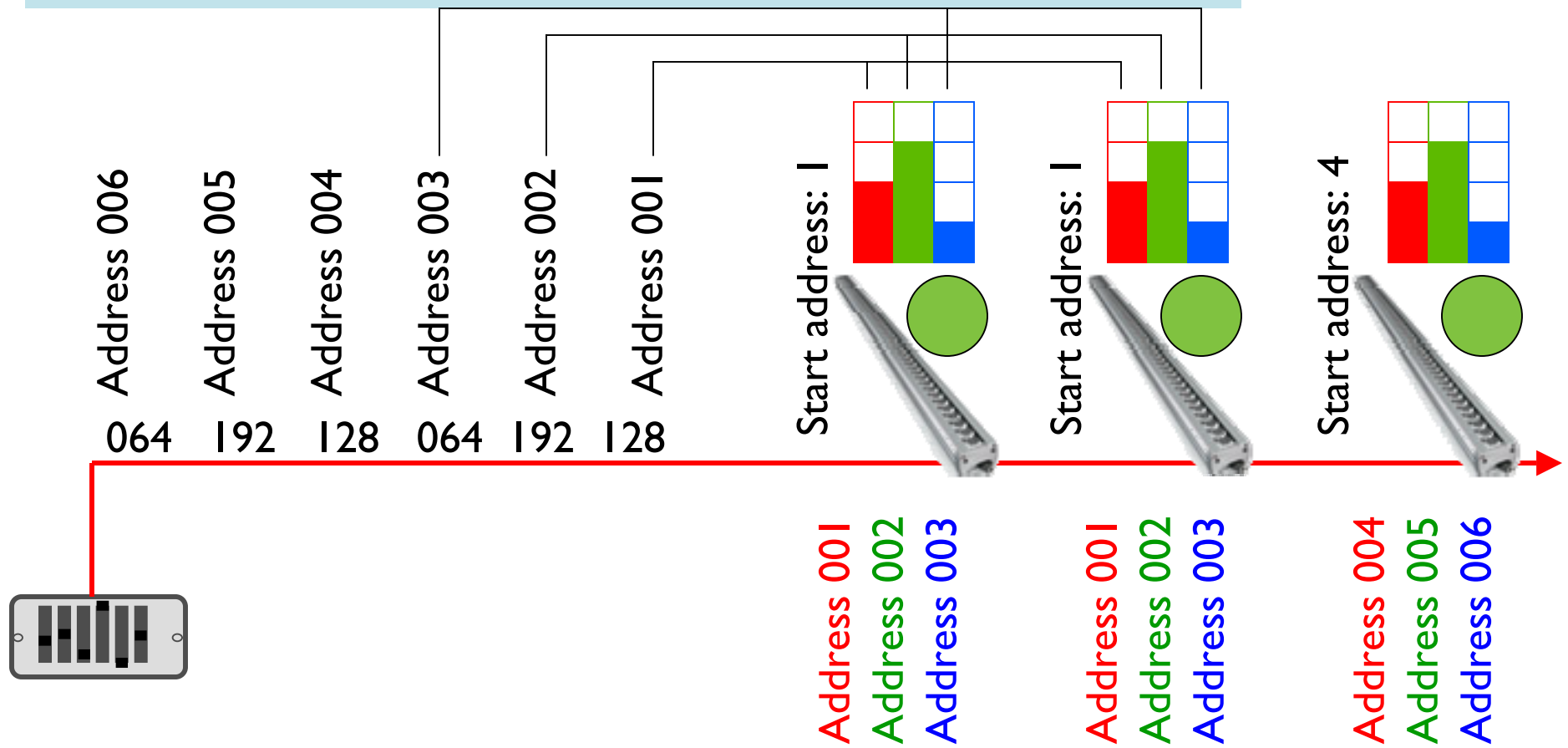
One DMX line can control $512/3=170$ individual RGB units

The DMX signal in scene setting



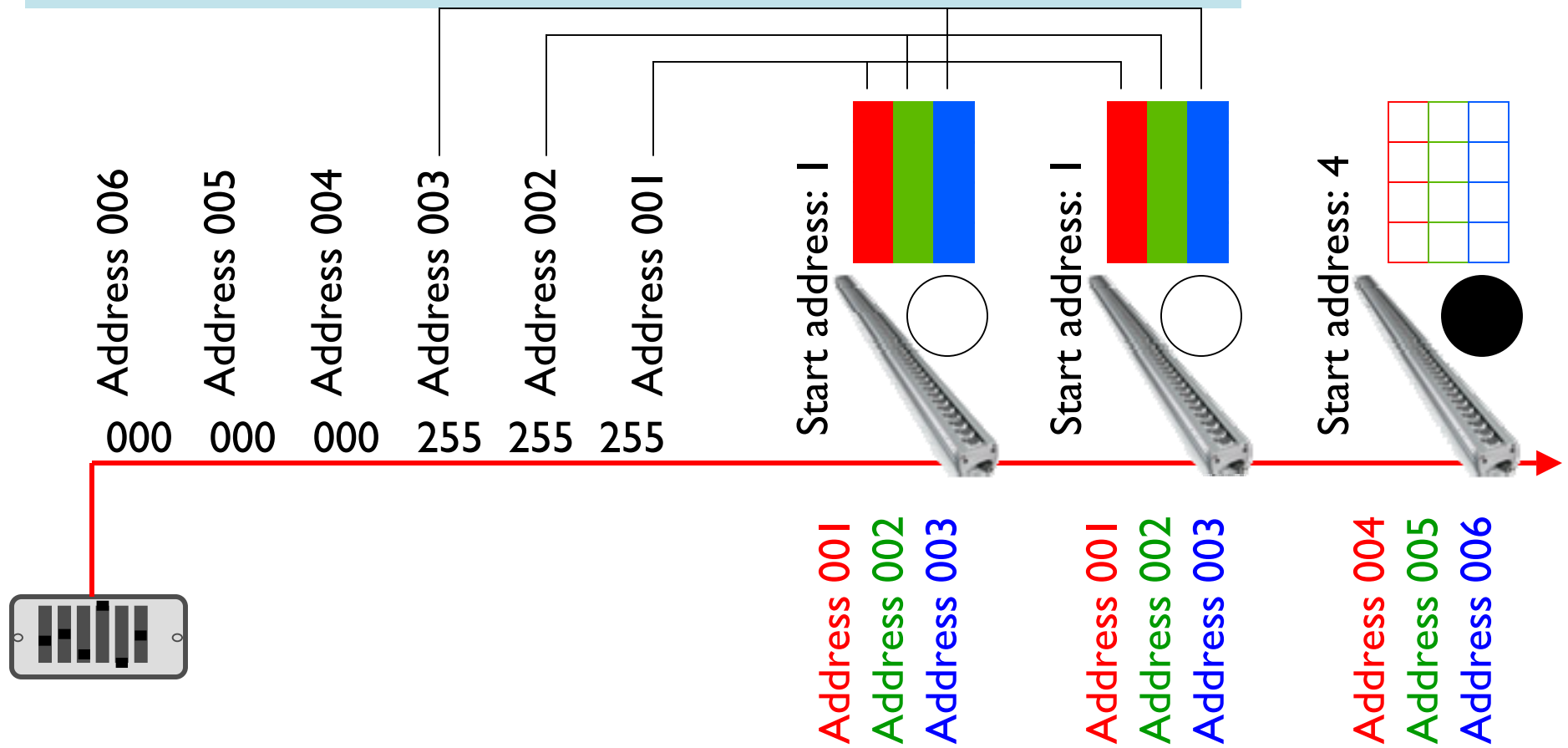
The DMX signal in scene setting

With changing the DMX values, different colours are created



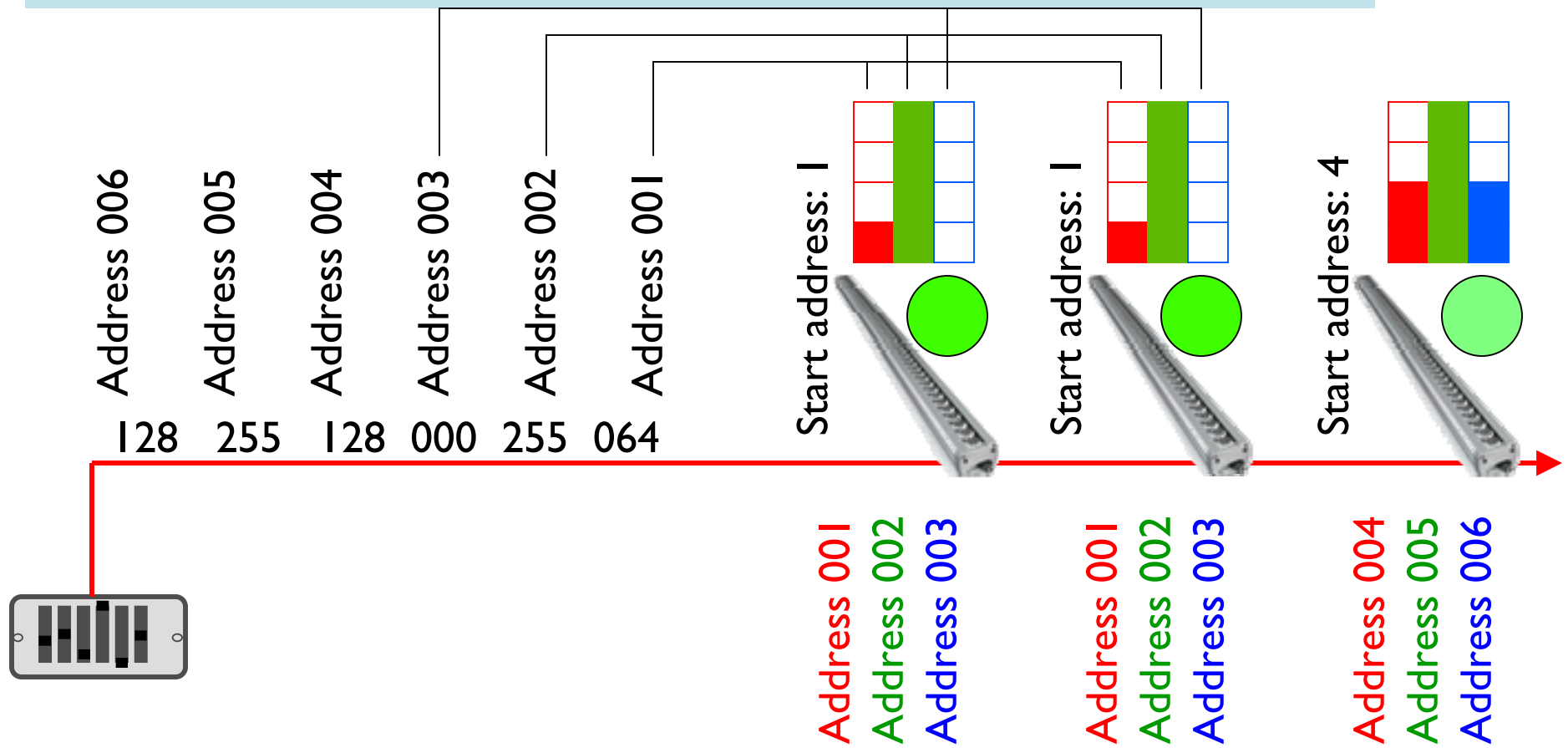
The DMX signal in scene setting

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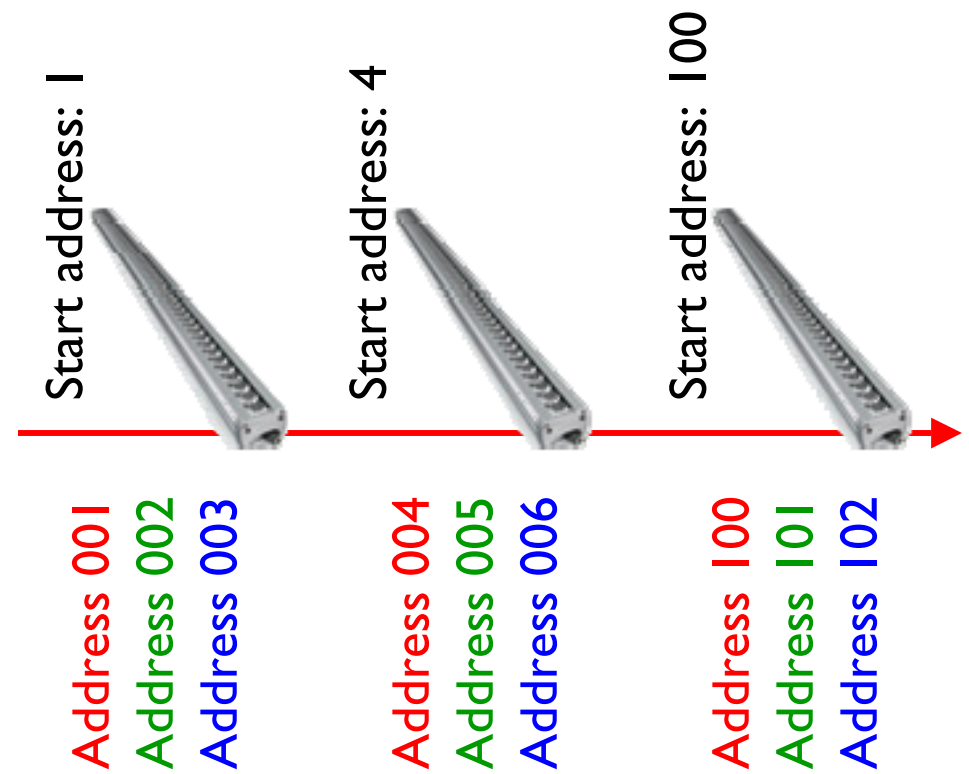
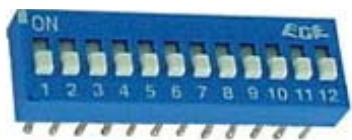
The DMX signal in scene setting

Note: luminaires with the same address will always react the same!



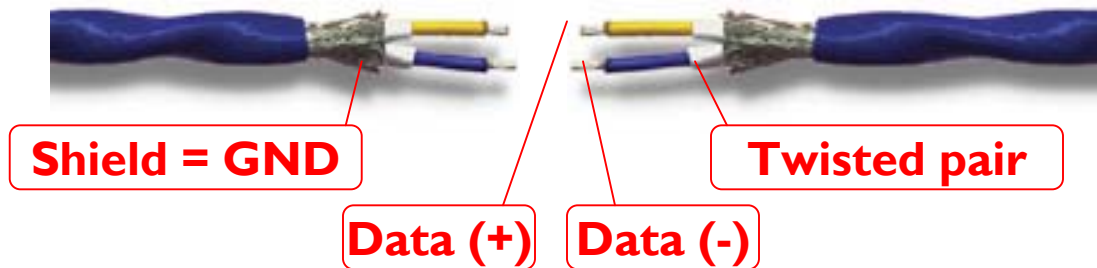
Addressing luminaires

How a start address should be changed depends on the luminaire.

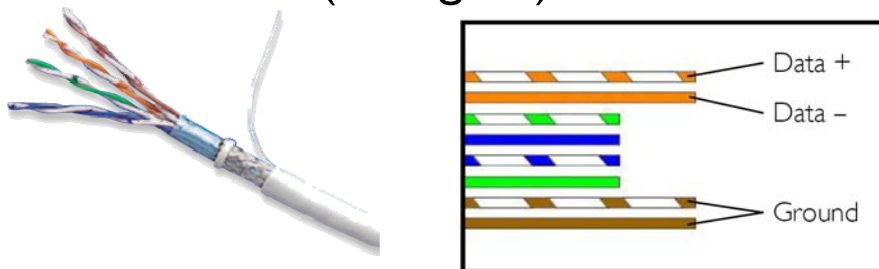


The DMX cable explained

A good DMX control cable is a RS485 “shielded twisted pair”
 This exist of 3 connections; 2 signals and a ground (GND).

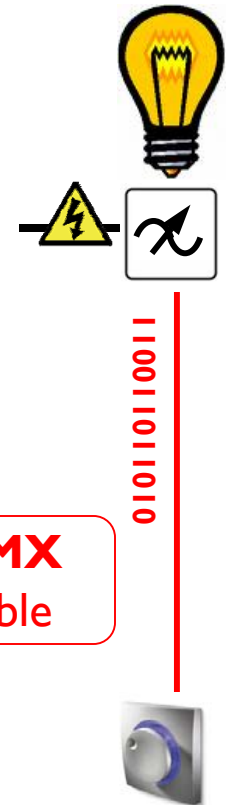


Shielded CAT.5 (or higher) cable can also be used.



CAT.5	S/UTP, F/UTP SF/UTP
CAT.6	U/UTP, S/FTP, S/STP
CAT.7	S/FTP, S/STP

DMX
cable



The data (+) and data (-) signal create the actual DMX signal
 Ground must be connected for reference, and to prevent interference.

The DMX connector explained

Preferred DMX connectors are RJ45

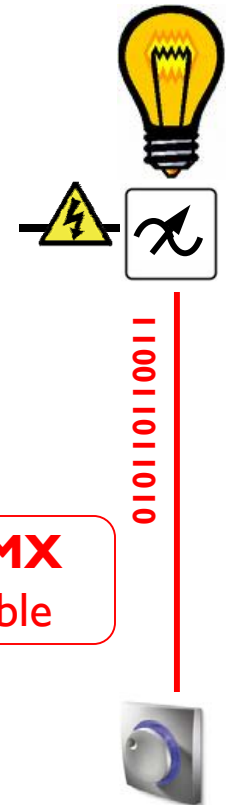


and Neutrik XLR 5 pin



PIN 1	DATA +
PIN 2	DATA -
PIN 3	
PIN 4	
PIN 5	
PIN 6	
PIN 7	GND
PIN 8	GND

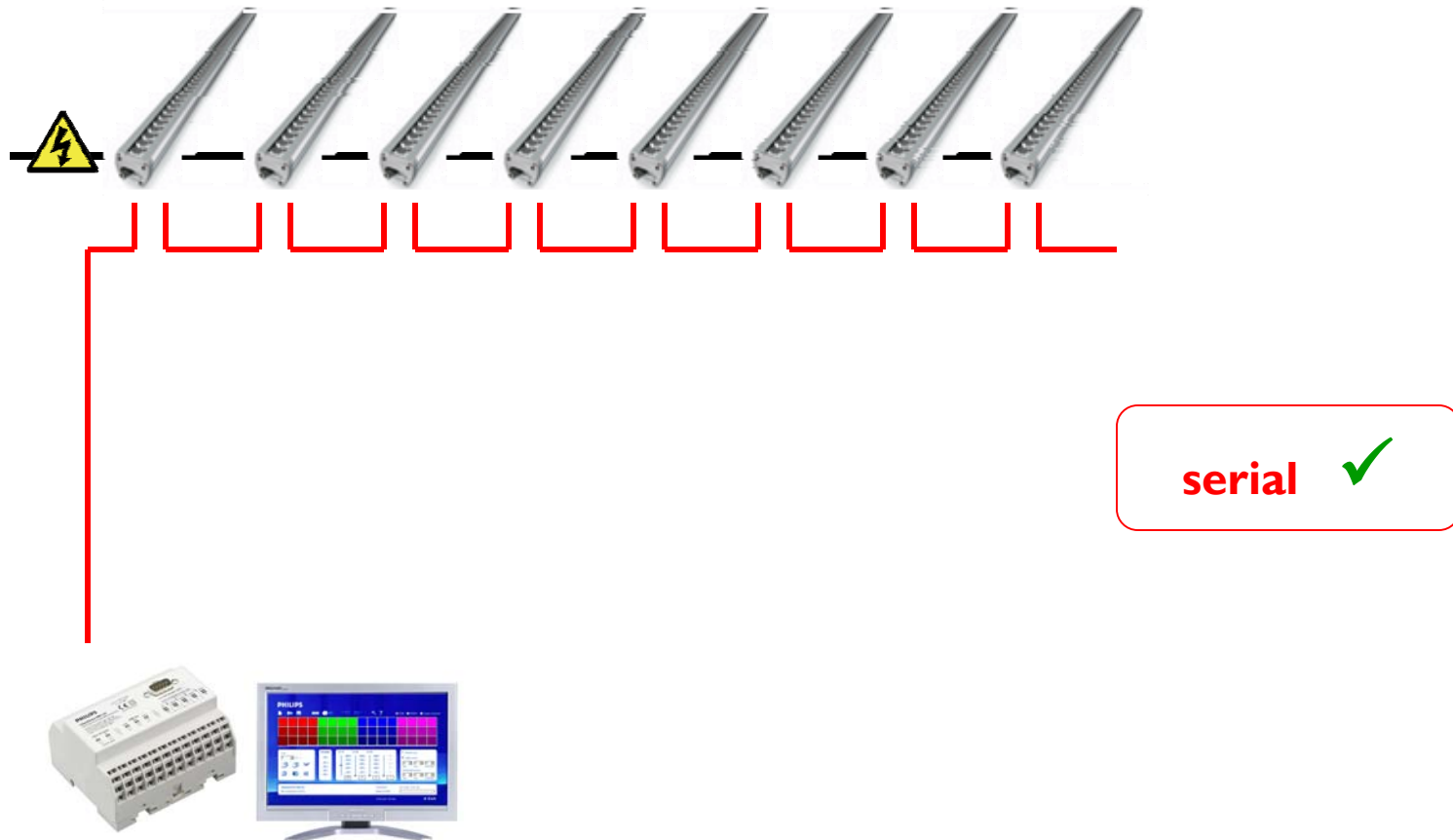
PIN 1	GND
PIN 2	DATA -
PIN 3	DATA +
PIN 4	
PIN 5	



XLR make stronger connections and are suitable for thicker cables (male for incoming signal, female for outgoing signal)

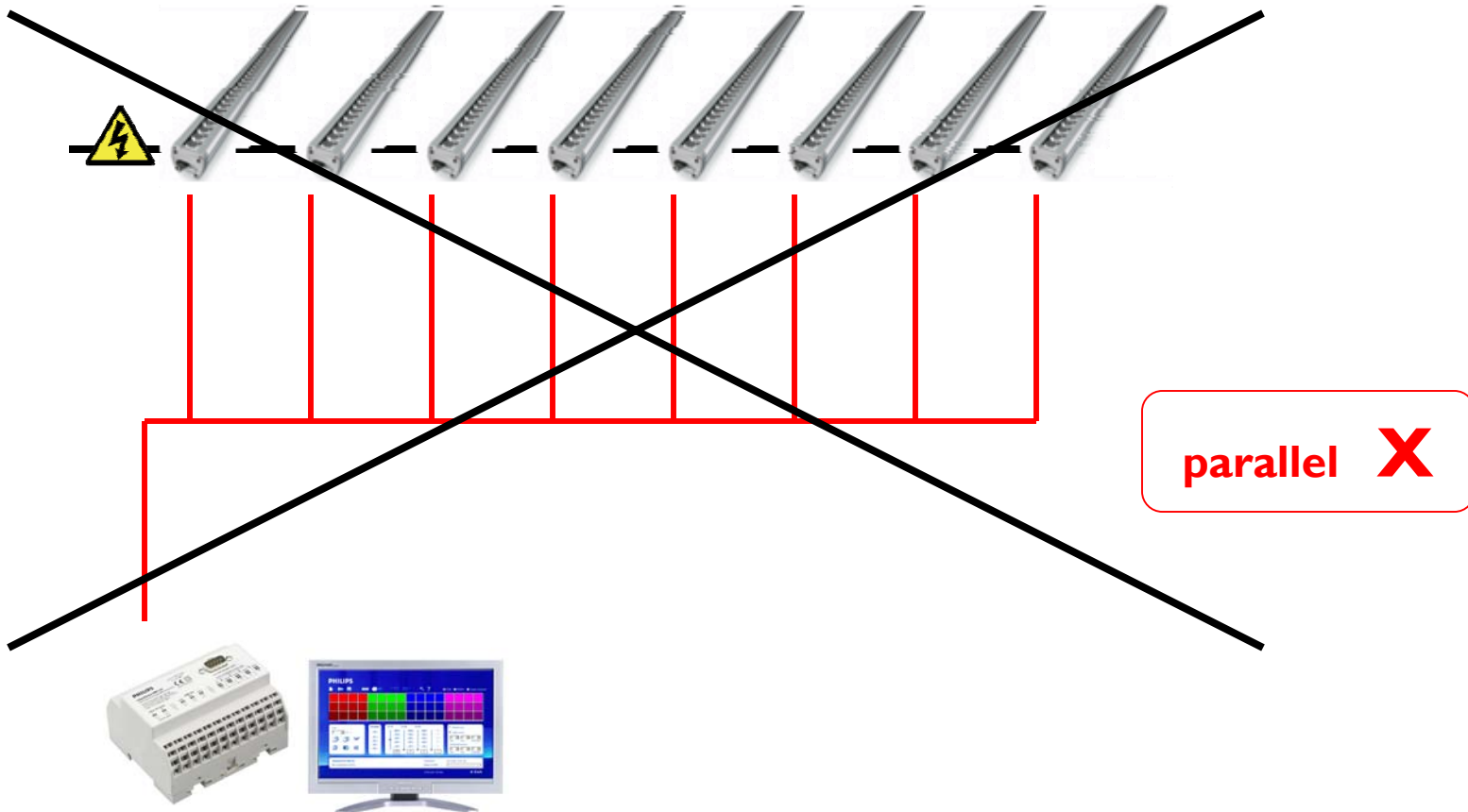
DMX topology

Topology with DMX is serial (total DMX length <300m)



DMX topology

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DMX topology

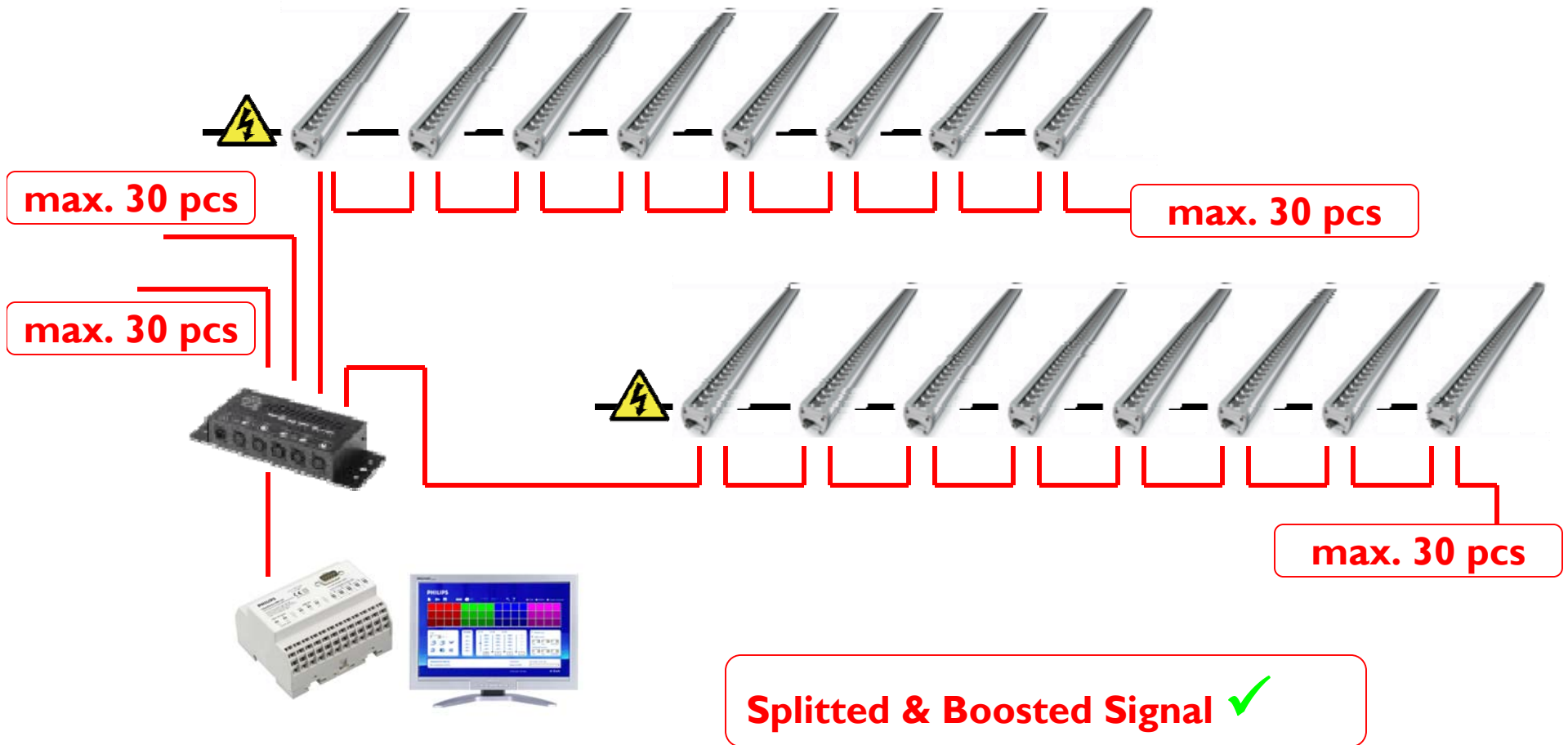
Notes:

- It is possible to split a DMX line; this can be done using additional hardware: a DMX-Splitter.
- Every DMX luminaire consumes “DMX energy”
Maximum 30 DMX devices can be connected to one DMX line.
After this the signal needs to be boosted with a DMX-Booster

The “4 way optosplitter” splits and boost the DMX signal.



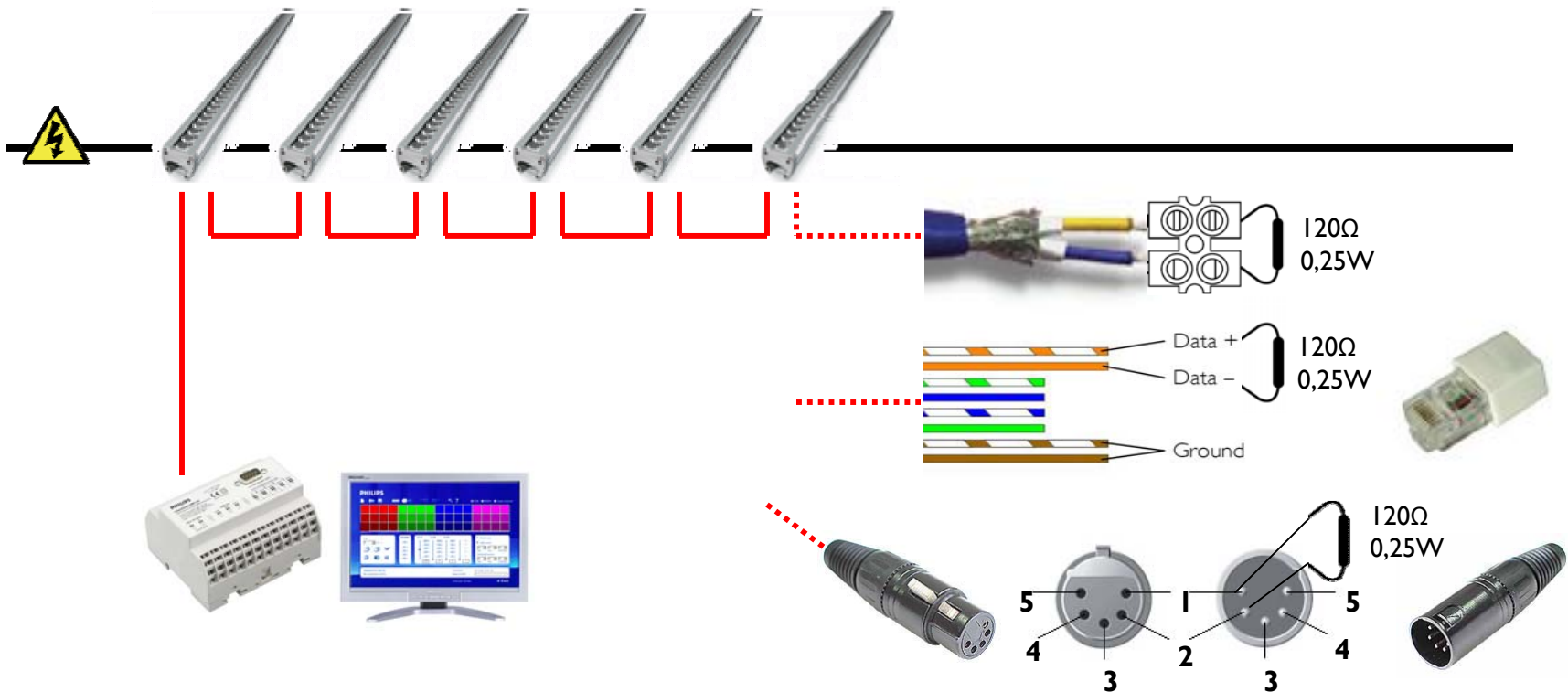
DMX topology



DMX termination

To create a stable DMX signal the end of each DMX line should be “terminated” with a 120Ω resistor

This should be mounted between the Data (+) and Data (-) signal



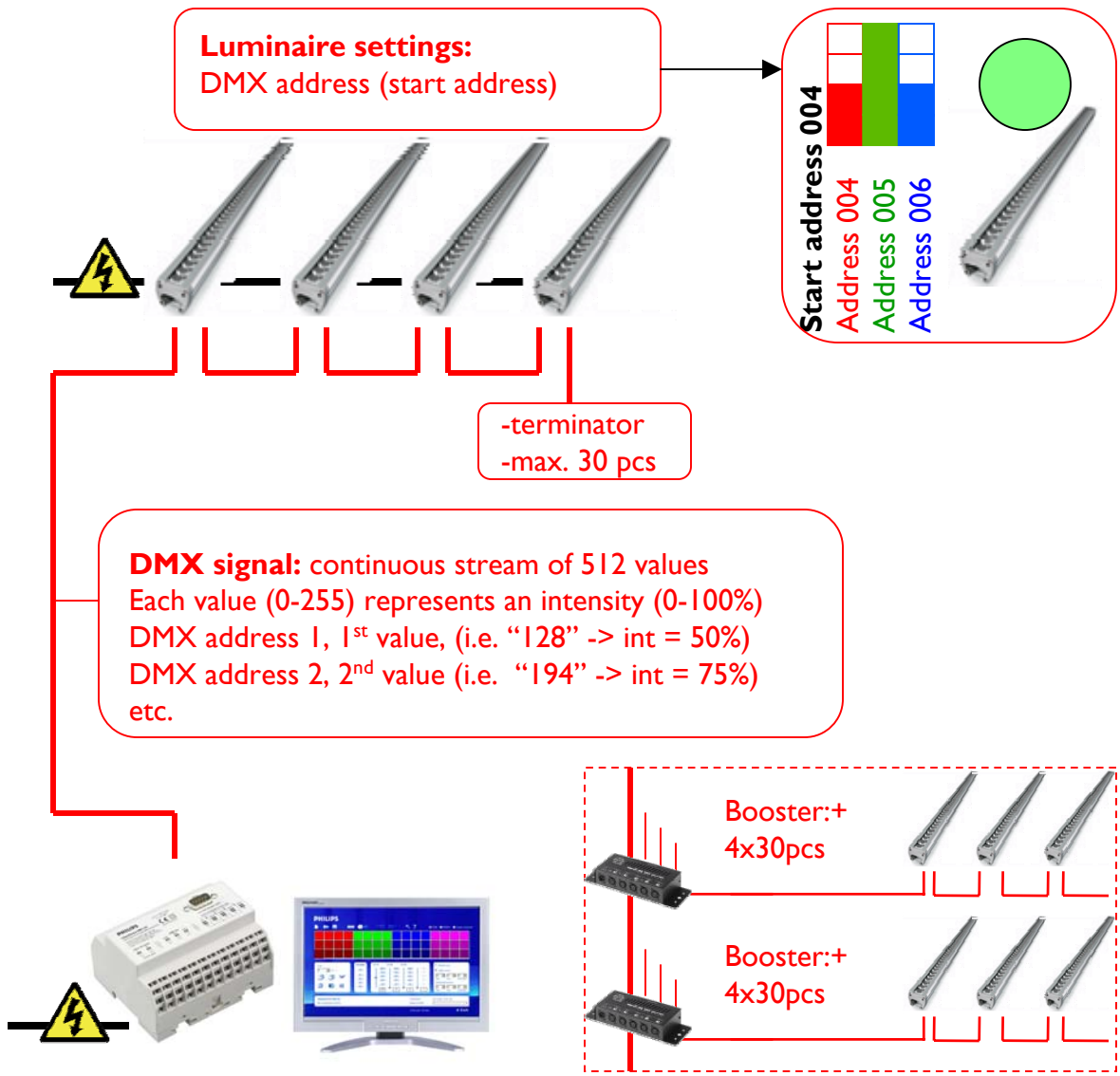
DMX technical characteristics (I)

Number of units max.	30 (Using boosters: unlimited)
Number of addresses	512 max
Signal level	several hundreds of millivolts
Speed	40 times 512 values / second +/- 250 kbaud
Termination	end of the line, 120 Ohm
Cable length max.	500m, (Using boosters: unlimited)
Cable type	Shielded twisted pair 100-120 Ohm Cat.5 S/UPT, F/UTP, SF/UTP Cat.6 U/FTP, S/FTP, S/STP Cat.7 S/FTP, S/STP
Cable topology	serial (line)
Termination	120 Ohm
Safety	DMX is SELV

DMX technical characteristics (2)

- A DMX system contains one controller (transmitter) and receiver(s)
- Information is transferred by modulating the two signal wires in opposite way. Ground is needed as reference
- An receiver has to be given an address. This is a number between 1 and 512. This address cannot be changed via the DMX connection
- DMX is based on RS485 communication. RS485 is two way communication, this is not implemented in DMX (one way only)
- DMX is invented to replace a multiplexed analog system
- In DMX communication there is no address info. The receiver counts the messages
- Random addressing is not possible. Addresses cannot be left out.
- A DMX value can mean anything, depending on receiver. For luminaires with intensity only most often a linear intensity curve is used.
- Standard: “E1.11, USITT DMX512-A”, maintained by ESTA

Summary “Introduction to DMX”



512 addresses
(i.e. 170x individual RGB)

max 30 DMX devices

Unlimited DMX devices using
boosters

Serial topology

Special DMX cable
(shielded twisted pair 120Ω)

Commissioning:
depends on luminaire /
controller

