

**Constant current fixtures are to be wired in SERIES and require a MINIMUM and MAXIMUM number of fixtures connected to a driver as indicated on the following page.**

**NOTE:**

**Powering or testing less than the minimum number of fixtures per driver**

**or**

**connecting fixtures with the driver powered (live wired)**

**or**

**wiring them in parallel will**

**IMMEDIATELY and PERMANENTLY DESTROY the fixtures and void the warranty.**

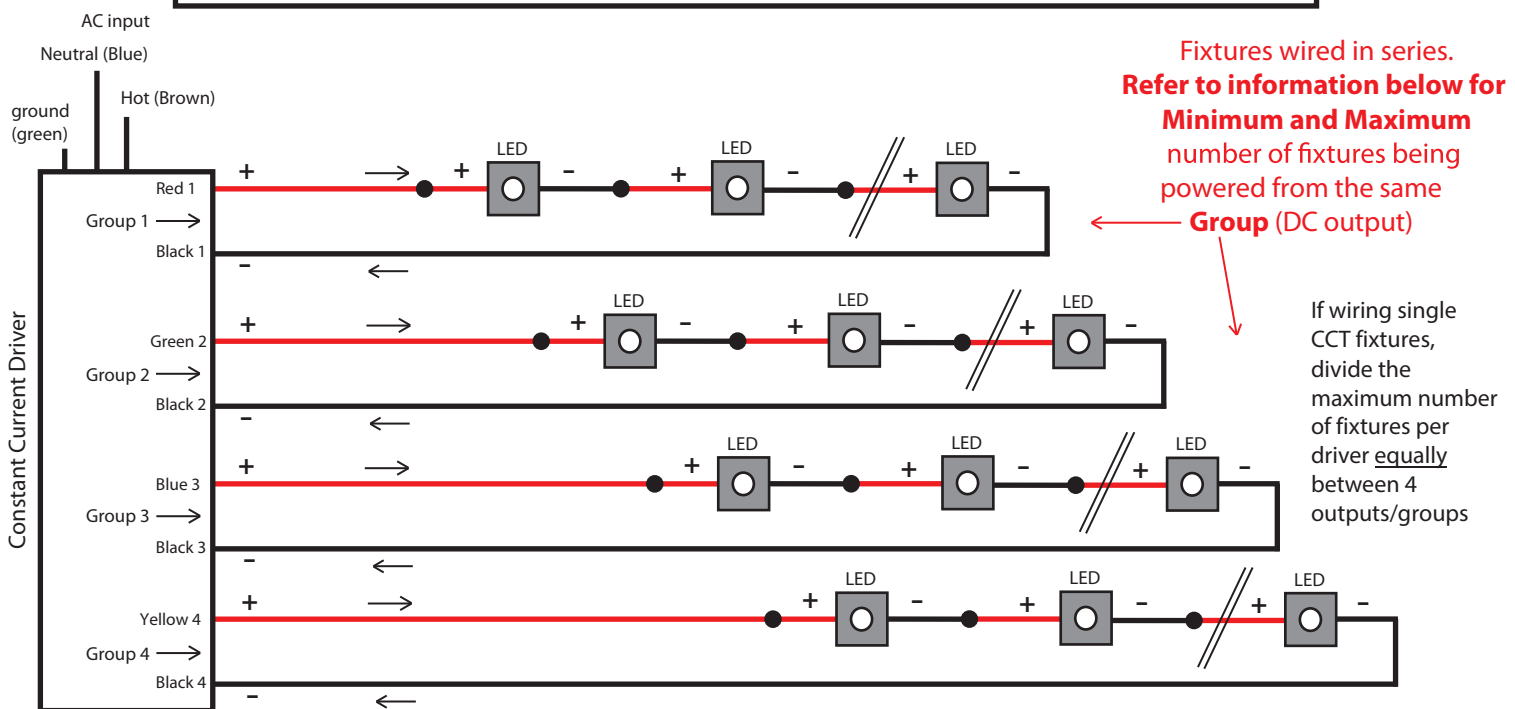
**Carefully read instructions prior to installation and testing.**

# Constant Current drivers

## Wiring Key Points

1. This product shall be installed by a qualified electrician.
2. Make sure the main power supply to the driver is turned off when wiring either the LEDs or driver.
3. LEDs shall be wired in series as shown in wiring diagram. CAUTION: parallel wiring will damage LEDs.
4. Wire shall be 18 awg stranded minimum. Large gauge wire shall be used to limit voltage drop in order to maintain the proper operating voltage. Take every precaution to avoid interference from other electrical circuits and equipment.
5. Dimming circuits are more sensitive to voltage drop and electrical interference from other electrical sources.
6. Isolating LED wiring by dedicated circuit for each control zone is recommended.
7. Contractor shall verify the fixture quantities connected to the driver are compatible with the driver's specifications prior to energizing the circuit.
8. All Class II power cable remote wiring by others.

**LED's can be permanently damaged if these points are not followed**



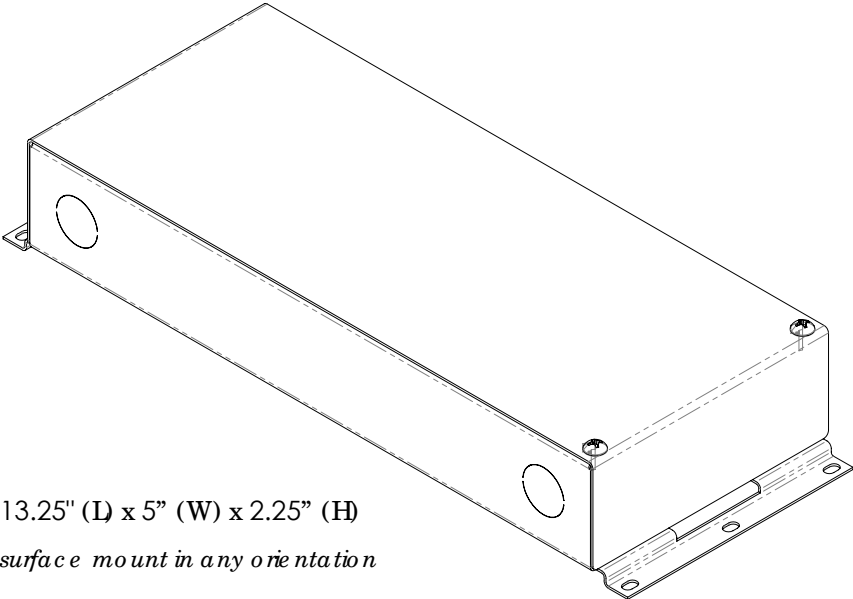
Driver	AC Input	Dimming	Maximum number of RGB/ RGBW fixtures	Maximum number of single CCT fixtures	Current setting (mA)
PW50S-M4Z0X	120/277V	DMX	Group 1: Group 2: Group 3: Group 4:	1	

Please note: Dimming/control wiring not shown in the diagram above.

**inter•lux**

Project:	Type:	Date:
Manufacturer: LINEALIGHT	Fixture:	

# Dry Location Enclosure

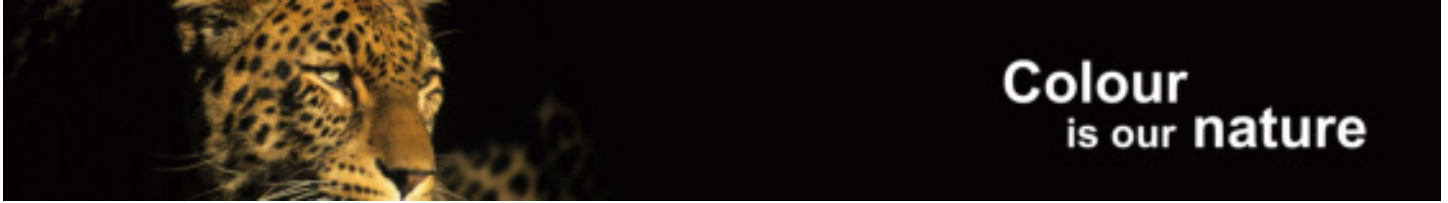


13.25" (L) x 5" (W) x 2.25" (H)  
*surface mount in any orientation*

### Maximum Wiring Distance Guide\*

Wire Gauge	Maximum Lead Length
18	72 ft (22 m)
16	118 ft (36 m)
14	150 ft (46 m)
12	200 ft (61 m)

\*Actual distance must be calculated by installer.  
Must comply with NEC code.



## 50W DMX/RDM Full-Colour (RGBW) Dimmable LED Driver

### POWERdrive

POWERdrive AC's dynamic response can be tuned to fit any content - from exceptionally smooth fades in architecture to fast-paced video in entertainment. This constant current LED driver is DMX/RDM compatible, with a fully isolated DMX/RDM interface to all inputs and outputs.

### Product offering



#### POWERdrive 50S-M4Z0X

Part number P/N	PW50S-M4Z0X1
Product description	POWERdrive AC, 50W, DMX/RDM, 4 control channels, constant current, 4x 55V outputs, side feed, square metal

### Features & benefits

Natural dimming	Dim to dark, smooth brightness changes, excellent flicker performance, adaptable dimming curves, configurable minimum dimming level
Programmable	4 x fully programmable, Class-2, constant current LED outputs which operate across a wide operating window
Performance	Universal input voltage range, low inrush current and total harmonic distortion (THD), high power factor and efficiency
Camera compatibility	Hybrid HydraDrive technology is proven to work in TV studios and security camera environments
DMX/RDM	DMX/RDM compatible full-color (RGBW) LED driver
Isolated DMX interface	Improved immunity against surge events and enhanced robustness against accidental mis-wiring

## Warranty

Warranty period [General Terms and Conditions](#)

## Input characteristics

Nominal input voltage range AC 120 - 250V (ENEC), 120 - 277V (UL)

Absolute input voltage range AC 108 - 305V

Nominal input voltage range DC 120 - 250V

Maximum input current AC  
0.5A @ 120V  
0.26A @ 230V  
0.22A @ 277V

Input frequency range 50 - 60Hz

Efficiency at full load 86%

Power factor at full load >0.95

THD at full load <20%

Maximum inrush current AC  
<100mA<sup>2</sup>s @ 120V  
<100mA<sup>2</sup>s @ 230V  
<100mA<sup>2</sup>s @ 277V

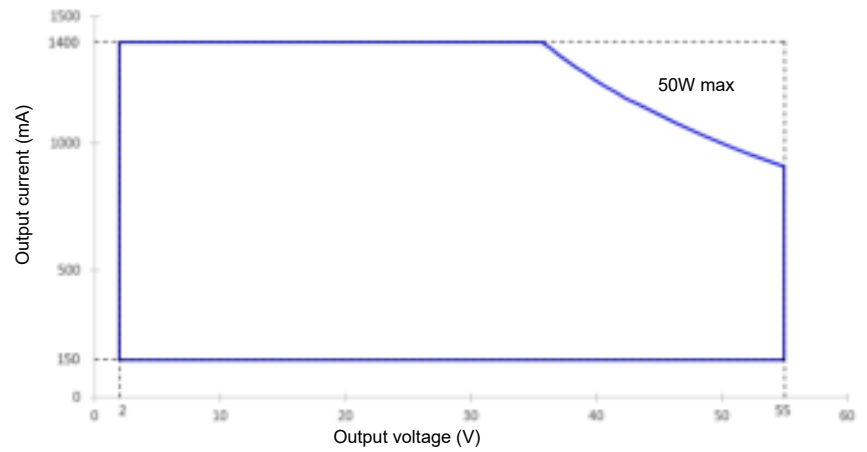
Surge protection 2kV differential mode (DM)  
2kV common mode (CM)

Maximum standby power <0.5W

**Output characteristics**

Maximum LED output power	50W
Number of LED outputs	4 (UL Class 2)
Programmable LED output current range	150 - 1400mA per LED output.  The cumulative current across all LED outputs shall not exceed 3400mA at any point in time during normal operation
LED output type	programmable in 1mA steps via DMX terminal and FluxTool
LED output current tolerance	+/- 5% at programmed LED output current
LED output voltage range	2 - 55V

Operating window



Startup time < 500ms, see Design Guide for details

## Control characteristics

Control channels 1 – 4 (default)

Multiple LED outputs can be mapped onto a single DMX group. For more details, see the Design Guide.

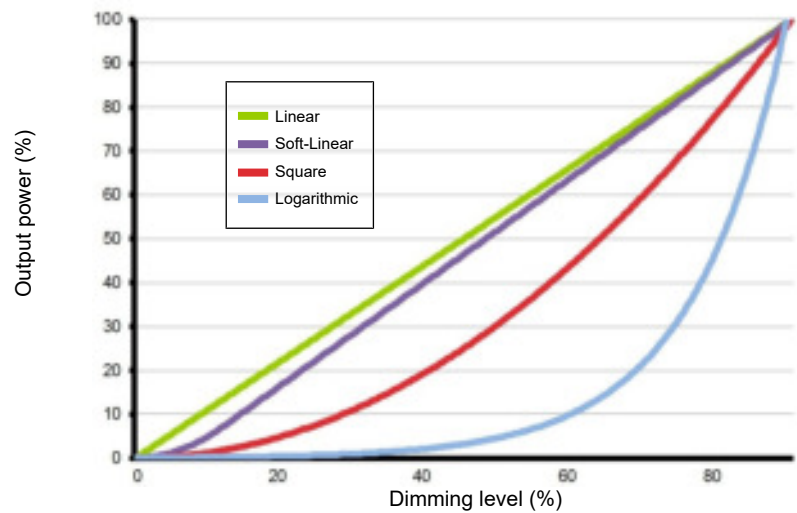
Control protocol DMX/RDM

Dimming range 100% - 0.1%

Dimming curve options  
 Logarithmic (default)  
 Linear  
 Soft-Linear  
 Square

Dimming method Hybrid HydraDrive

Dimming curves



## Programming tools

Programming interface [TOOLbox pro \(TLU20504\)](#)

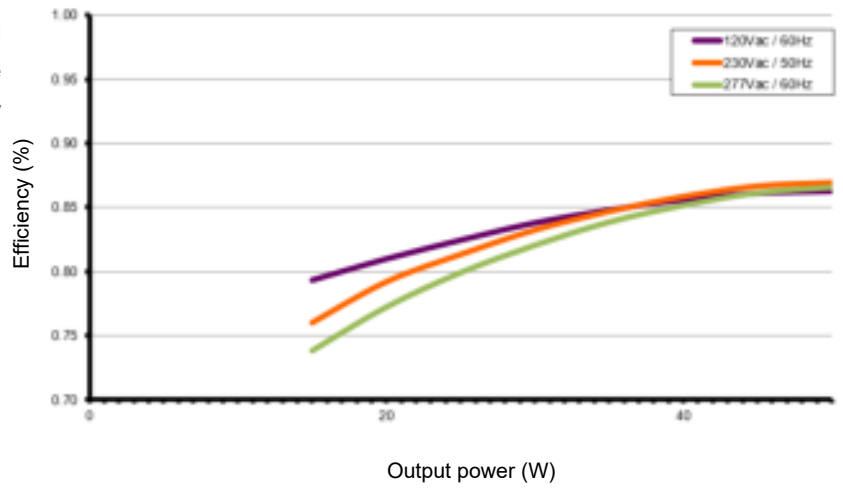
Programming cable set [TOOLbox pro to LED driver, programming cable, 5pcs \(TLC03051\)](#)

Programming software [FluxTool](#)

## Performance

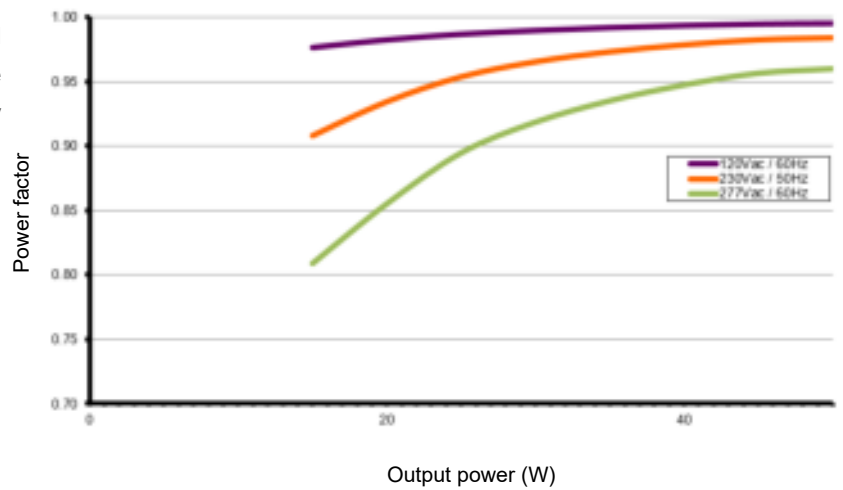
### Typical efficiency vs load

Tested with a load of 17 LEDs in series, programmed for 225mA and at 25 °C ambient temperature. The measurements below 50W were performed by dimming the light output.



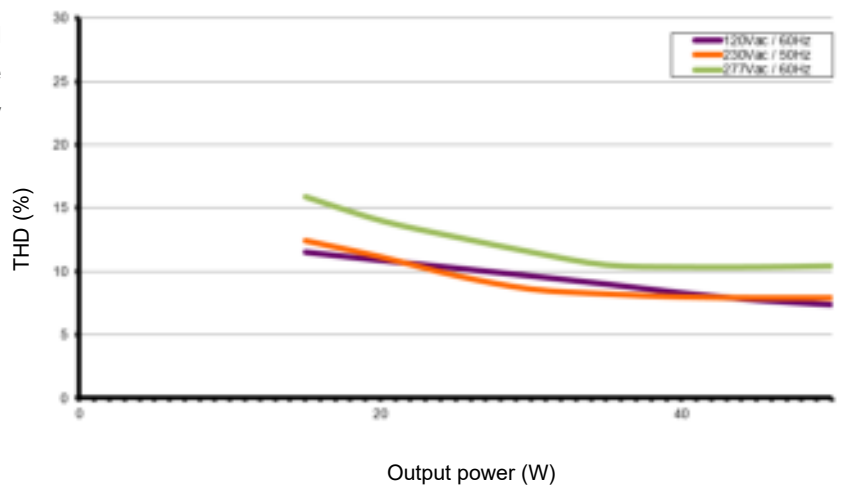
### Typical power factor vs load

Tested with a load of 17 LEDs in series, programmed for 225mA and at 25 °C ambient temperature. The measurements below 50W were performed by dimming the light output.



### Typical THD vs load

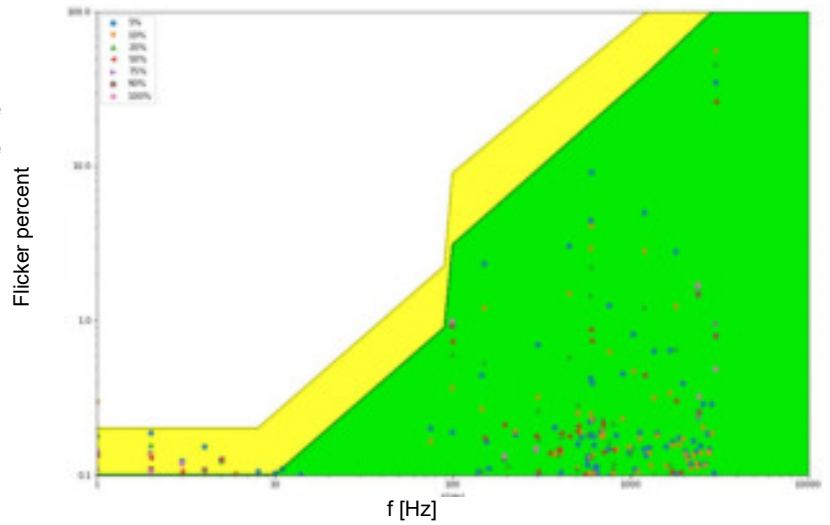
Tested with a load of 17 LEDs in series, programmed for 225mA and at 25 °C ambient temperature. The measurements below 50W were performed by dimming the light output.





Typical flicker performance

Typical flicker percent as a function of frequency, measured across the dimming range. The results are overlaid with the low-risk (yellow) and no observable effect (green) levels as defined in IEEE P1789.



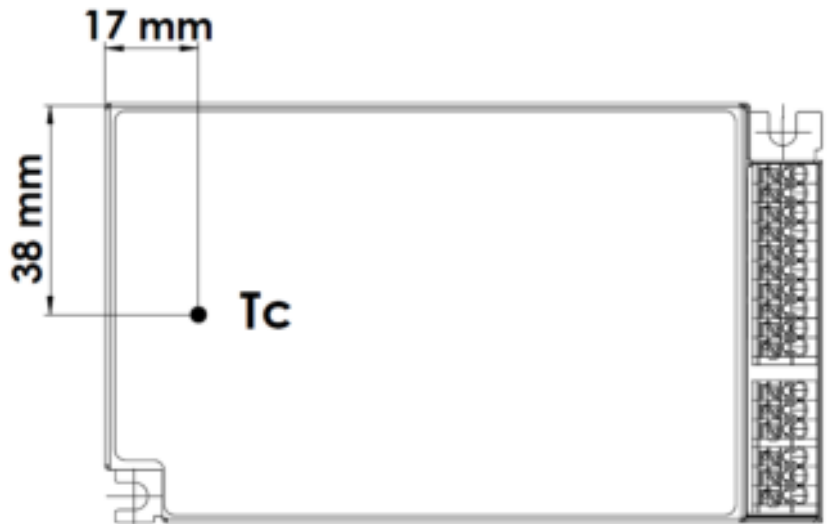
Environmental conditions

Operating ambient temperature (Ta) range -20 °C to +50 °C

Maximum operating case temperature (Tc max) 85 °C

Lifetime 50k hours at a maximum case temperature (Tc) of 85 °C

Tc point location



Acoustic noise – steady state <24dBA (Class A)

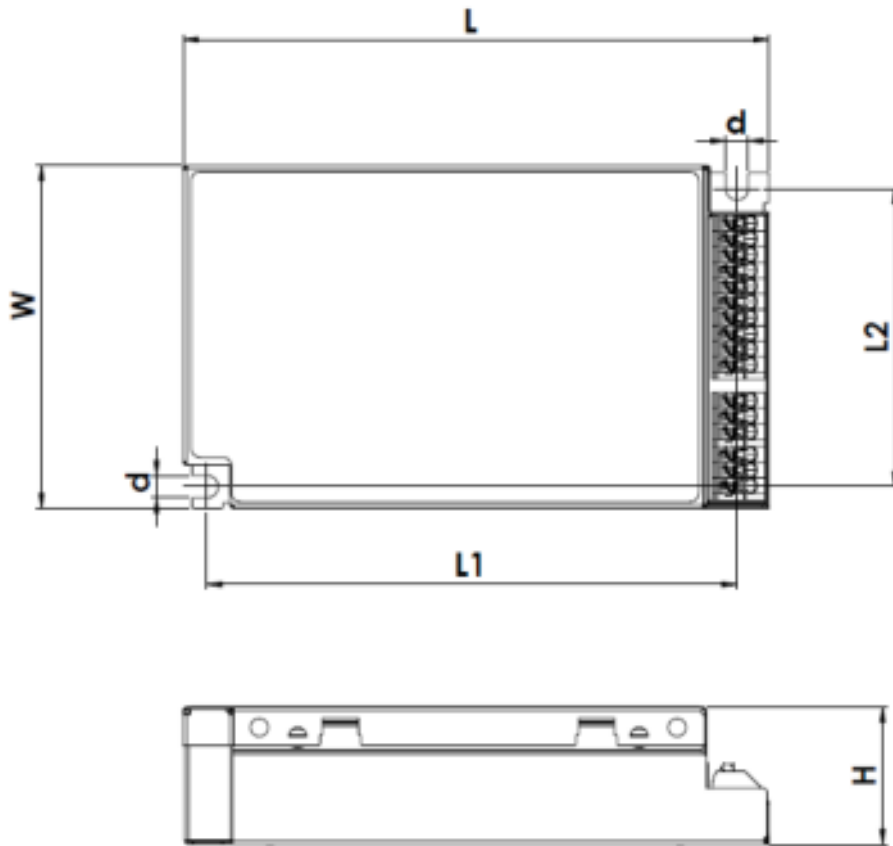
## LED driver protection

Thermal	The output current on all LED outputs is automatically decreased whenever the internal LED driver temperature exceeds a factory preset temperature. The LED output current is increased once the internal LED driver temperature drops below this internal temperature threshold. If the internal LED driver temperature continues to increase, despite a decrease in output current, the LED driver will eventually shut down.
LED output short circuit	The LED output current is cut off whenever the LED driver detects a short-circuit. The LED driver will attempt a restart every 400ms after a short-circuit is detected.
LED output open circuit	All LED outputs are turned off whenever the LED driver detects an open circuit on any one of the LED outputs. The LED driver will automatically attempt a restart every 400ms after an open circuit is detected.
LED output overload	The driver monitors the cumulative load across all LED outputs. Whenever this cumulative load exceeds the maximum output power rating of the LED driver, the output current on all LED outputs is sequentially scaled down until the cumulative load drops below the maximum output power rating of the LED driver.
Reverse polarity	The LED driver will not yield any current if the polarity of the load on the LED output is reversed. This situation will not damage the LED driver but may damage the LED load.

## LED protection

Thermal protection LED	An external NTC thermistor, which is placed on a PCB near the LEDs, can be connected to the driver via the LEDcode/NTC terminals. The output current to the LEDs is then decreased by 75% whenever the NTC exceeds a maximum allowable temperature, which is specified by the user in the FluxTool software. The default NTC temperature limit is set to 70 °C.
Thermistor value	47kΩ
Suitable thermistors	Leaded: Vishay, P/N 238164063473 Screw: Vishay, P/N NTCASCWE3473J

**LED driver mechanical details**

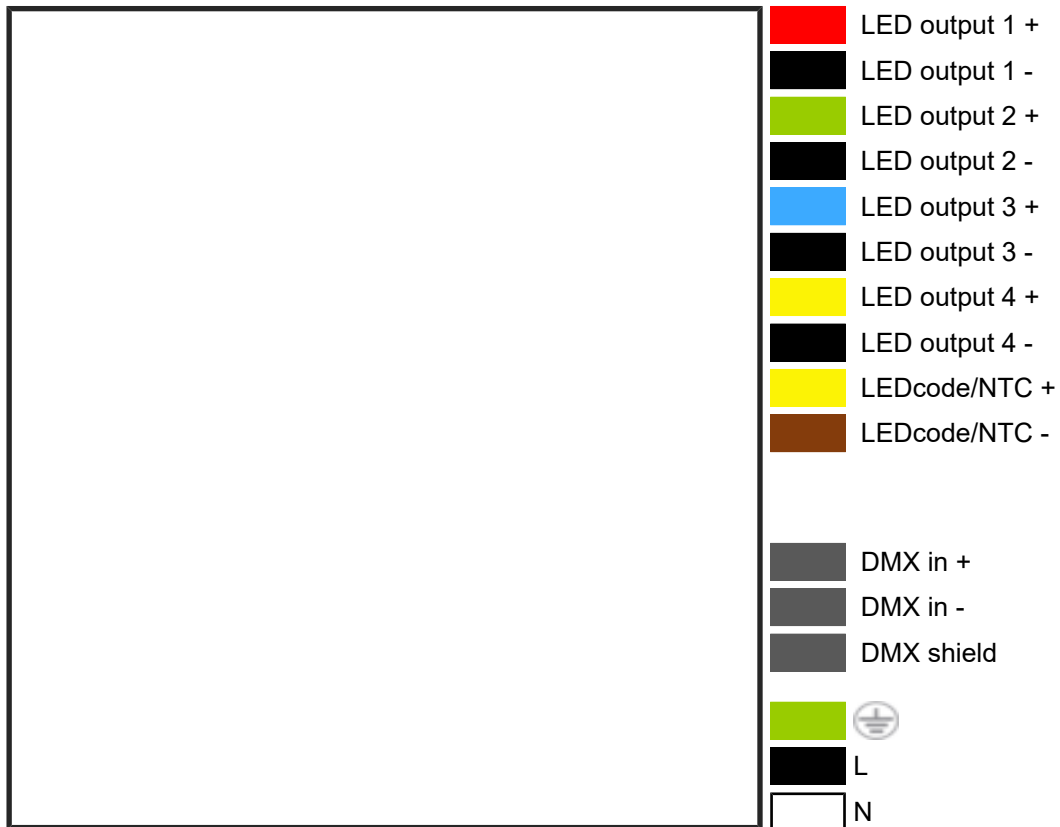


Length (L)	typical: 130 mm / 5.13 in maximum: 130.9 mm / 5.15 in
Width (W)	typical: 76 mm / 3 in maximum: 76.2 mm / 3.02 in
Height (H)	typical: 30.5 mm / 1.19 in maximum: 30.6 mm / 1.20 in
Mounting hole diameter (d)	5 mm / 0.20 in
Center to center mounting hole distance (L1)	118 mm / 4.64 in
Center to center mounting hole distance (L2)	66 mm / 2.60 in
Weight	328 g

**Packaging**

Length x Width x Height	500 x 310 x 190 mm / 19.7 x 12.2 7.5 in
Weight (including products)	13.7 kg
Products per box	40 pcs

**Connector layout**



**Wiring specifications**

Connector type	push-in terminals
Connector supplier and series	Wago 250 / DECA MX522
Wire strip length	9mm (11/31in)
Wire core cross section	AWG 20-16, 0.5 – 1.5 mm <sup>2</sup> (mains, LED output, LEDcode) AWG 24-16, 0.2 – 1.5 mm <sup>2</sup> (DMX)
Wire Type	UL: solid (mains); solid or stranded (LED outputs, DMX, LEDcode) ENEC: solid or stranded

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**Automatic circuit breakers (MCB)**

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Maximum loading	MCB type	B10	B13	B16	C10	C13	C16
	Number of LED drivers (120Vac)	14	16	20	14	16	20
	Number of LED drivers (230Vac)	26	30	38	26	30	38
	Number of LED drivers (277Vac)	31	36	45	31	36	45

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**Standards and compliance**

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UL Listed, Class P	UL 1310 UL 8750 (Class 2 output)
ENEC safety	EN 61347-1 EN 61347-2-13 (Emergency lighting)
ENEC performance	EN 62384
Conducted emissions	EN 55015  FCC title 47 CFR part 15 class B
Radiated emissions	EN 55015  FCC title 47 CFR part 15 class B
Radio disturbance characteristics	EN 55022
Harmonic current emissions	EN 61000-3-2
Electrostatic discharge	EN 61000-4-2
RFE field susceptibility	EN 61000-4-3
Electrical fast transient	EN 61000-4-4
Surge immunity	EN 61000-4-5
Conducted radio frequency	EN 61000-4-6
Voltage dips	EN 61000-4-11
Electromagnetic immunity	EN 61547
DMX	ANSI E1.11 – 2008 (R2013), USITT DMX512-A ANSI E1.20 - 2010
Surge protection mains	IEC 61000-4-5 level 3: 2kV DM, 2kV CM @ 2 Ohm  ANSI 62.41 1991 category B1: 2.5kV DM, 2.5kV CM @ 30 Ohm
Surge protection DMX	1kV CM
RCM	AS/NZS 61347.1, AS/NZS 61347.2.13
Restriction of hazardous substances	RoHS3 (Directives 2011/65/EU-2015/863/EU)
SVHC-list substances	REACH Art.33

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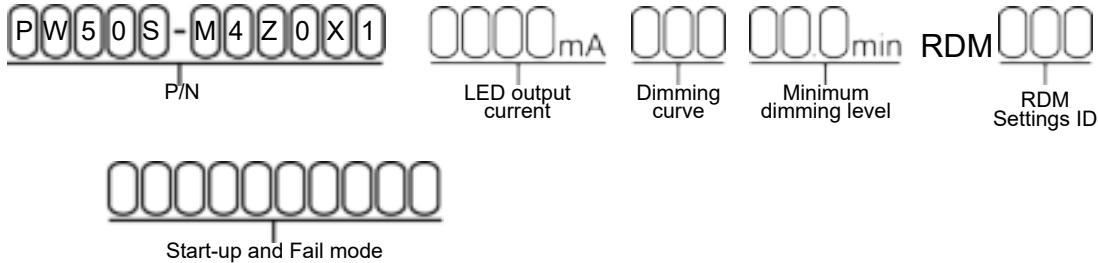
Certifications

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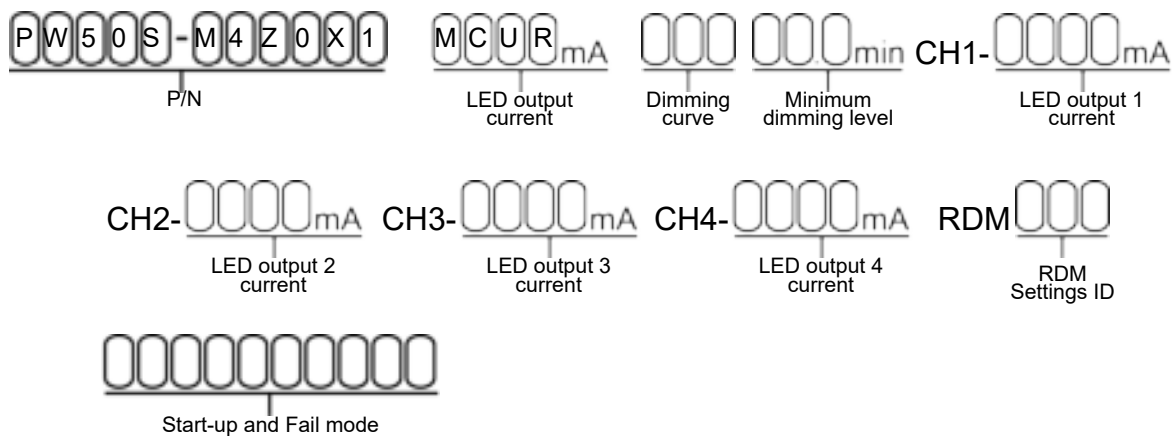


Order number configurator

Standard



Custom current



P/N	LED driver part number
LED output current	Enter value in 1mA increments, e.g. "811" for 811mA. The POWERdrive 50W/U driver is designed to deliver, by default, the specified output current on each LED output. If the output current is different per LED output, enter "MCUR" in LED output current and specify the differing output currents in LED Outputs 1/2/3/4.
Dimming curve	"LOG" for logarithmic (default) "LIN" for linear "SLN" for soft-linear "SQU" for square
Minimum dimming level	Leave blank for default minimum dimming level of 0.1%. Specify in 0.1% increments, e.g. "10.5" for 10.5%.



RDM Settings ID

The RDM Settings ID is a reference to a variety of RDM settings (e.g. Manufacturer ID, Device Model Description, RDM IDs) that are stored in the driver from the eldoLED factory. These settings cannot be changed by the user. RDM001 is the default RDM Settings ID and corresponds to the default eldoLED RDM settings. Customer-specific RDM settings can be programmed into the driver in the eldoLED factory. Contact your sales representative if custom settings are desired.

Default start-up and fail mode

Enter “ENTM” to start-up the driver at 20% and retain its last value with the loss of DMX (**default**).

To create a custom configuration, specify the start-up and DMX drop levels for all LED outputs using the format: S\_\_\_\_\_D\_\_\_\_\_, where S\_\_\_\_\_ defines the start-up level and D\_\_\_\_\_ defines the DMX drop level for LED outputs 1 - 4. Specify S\_\_\_\_\_DR if the last value must be retained when the DMX signal is dropped. The underscores in this custom configuration can be [0-9, F] corresponding to the option values in the table below. Make sure that the total output power and cumulative current of all LED outputs do not exceed the maximum ratings of the driver. For example specify S000FDR for an RGBW application that starts with only the 4<sup>th</sup> LED output (white) at 100% of the nominal drive current and retains the last value for every LED output when the DMX signal is dropped.

Selection	Description	Selection	Description
0%	0	60%	6
10%	1	70%	7
20%	2	80%	8
30%	3	90%	9
40%	4	100%	F
50%	5		

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## Safety

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Risk of electrical shock. May result in serious injury or death. Disconnect power before servicing or installing.

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The LED driver may only be connected and installed by a qualified electrician. All applicable regulations, legislation, and building codes must be observed. Incorrect installation of the LED driver can cause irreparable damage to the LED driver and the connected LEDs.

Pay attention when connecting the LEDs: polarity reversal results in no light output and often damages the LEDs.

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LED drivers are designed and intended to operate LED loads only. Powering non-LED loads may push the LED driver outside its specified design limits and is, therefore, not covered by any warranty.

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eldoLED products are designed to meet the performance specifications as outlined at certain operating conditions in the data sheet. It is the responsibility of the fixture manufacturer to test and validate the design and operation of the system under expected and potential use cases, including faults.

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Please observe voltage drop over long cable lengths. Longer cable lengths increase EMI susceptibility.

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Product renderings and dimensional drawings are generic for the housing type. Product label, connector type and quantity may vary.

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### Europe, Rest of World

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## How to wire DMX/RDM lighting systems

DMX/RDM is a robust and reliable system for lighting control. However, if not implemented correctly, problems can arise such as random flashing of lights, erratic operation and delays in responding to commands. This document explains the best practices in DMX wiring.

Below, a typical DMX universe is shown. The DMX controller sends signals over the DMX cable to the drivers. At the last driver, the cable has to be terminated with a 120Ω resistor to prevent reflections of the signal.

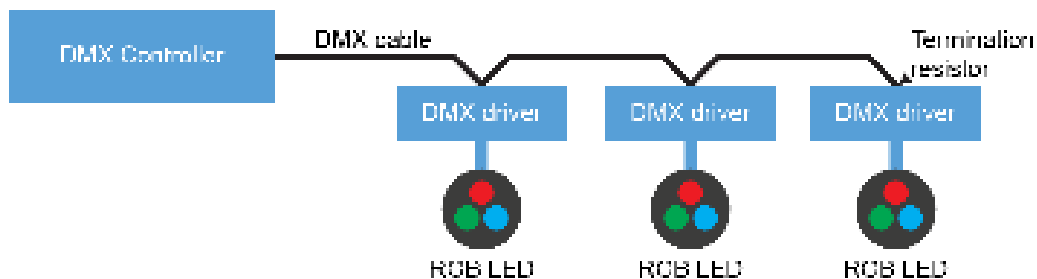


Figure 1 – Typical DMX universe

Important things to consider are:

- DMX is a three-wire system. Use all three!
- DMX is based on the EIA-485/RS-485 standard.
- Always use cable specifically designed for DMX / RS-485. These cables have an impedance of 120Ω and a low capacitance. For instance: Belden 9841 or 3105a.



Figure 2 – Belden 9841 cable

- DMX must be terminated with a 120Ω resistor to prevent reflections.
- A daisy chain topology should be used.
- After 32 unit loads a repeater/booster should be used.
- Keep cabling below 300 metres between the controller and the last driver.
- It is generally considered good practice to provide separate DMX in and DMX out/DMX thru connections to your fixture to aid in installation. This can be in the form of pigtailed, RJ-45 connectors or 5-pin XLR-connectors.

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## Connecting the cable on eldoLED drivers with 'DMX in' terminals only

Drivers with only one set of DMX terminals (DMX in +, DMX in -, and DMX in shield) use a standard DMX bus topology (daisy chain). At the last driver, a 120Ω resistor must be connected between the DMX in + and DMX in - pins of the driver as termination. This method is compatible with RDM.

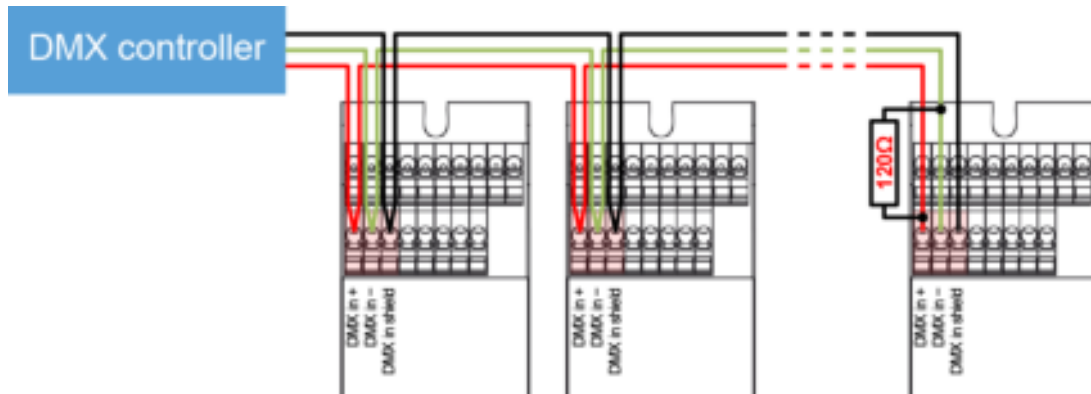


Figure 3 – Daisy chain topology with 'DMX in' only

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## Connecting the cable on eldoLED drivers with 'DMX in' and 'DMX thru' terminals

Some eldoLED drivers have an extra set of DMX terminals (DMX thru +, DMX thru - and DMX thru shield) in addition to the 'DMX in' terminals to make installation easier. Internally, these 'thru' terminals are electrically connected to the 'DMX in' terminals. These drivers also use standard DMX bus topology (daisy chain). The 'DMX thru' connections are compatible with RDM.

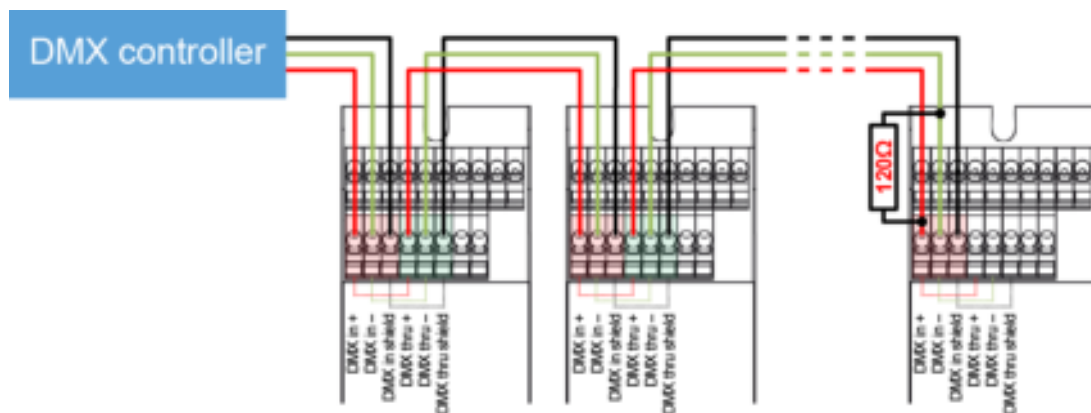


Figure 4 – Daisy chain topology with 'DMX in' and 'DMX thru'

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## Connecting the cable on eldoLED drivers with 'DMX in' and 'DMX out' terminals

Drivers with 'DMX out' terminals (DMX out +, DMX out - and DMX out shield) in addition to the 'DMX in' terminals provide a buffered DMX out signal. These drivers offer additional functionality on top of standard DMX. On some products 'DMX out' is called LEDsync.

- DMX out acts as a built-in booster or repeater, so no additional repeaters or boosters are necessary after 32 drivers.
  - DMX out provides automatic driver addressing possibilities.
  - With DMX out, it is possible to have mixed topologies instead of daisy chain only.
  - Only the first driver on the 'DMX out'-chain (master) is visible on RDM – slaves behind are not visible. If RDM is required, use the 'DMX in' terminals instead of 'DMX out'.
  - Each DMX out adds a delay of approximately 300μs. After 75 drivers, this delay will be visible.
-

- The maximum available DMX address is 480; DMX addresses 481 – 512 are reserved for 'DMX out'-features.
- If one driver in the chain fails, devices behind the failing driver will stop receiving DMX signals.
- Drivers without 'DMX out'-terminals or third party drivers should be first in the DMX chain, they cannot be connected behind drivers with 'DMX out'.

### Termination with DMX out

With drivers that have DMX out terminals extra care should be taken with termination, depending of the configuration. In short: termination is necessary after each cable run, but not at any T/Y-connections. Some examples:

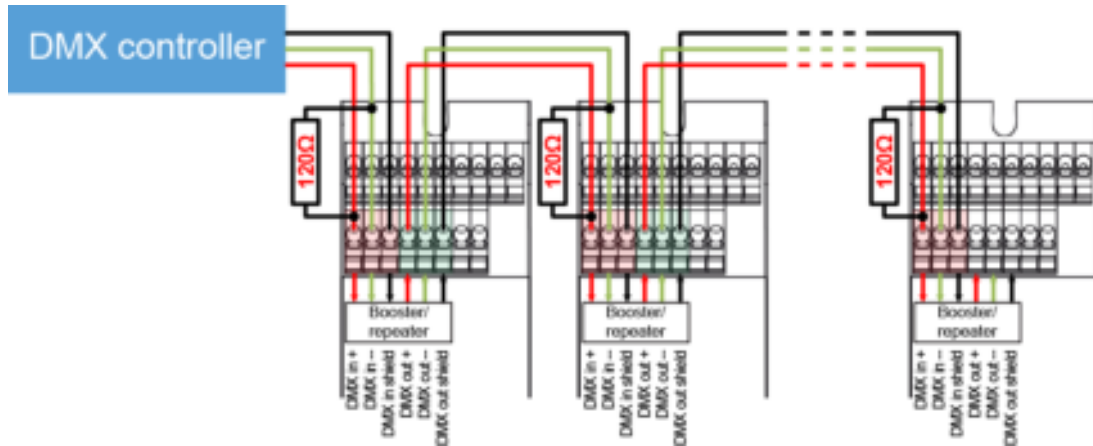


Figure 5 – Termination on each cable run

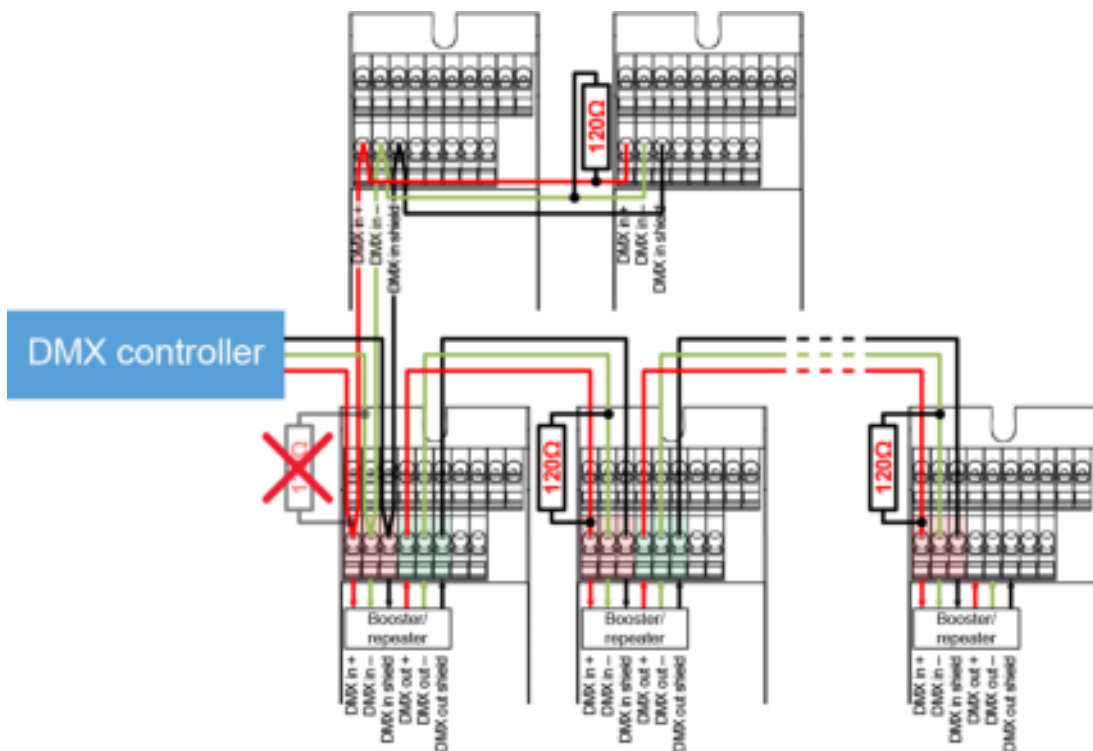


Figure 6 Mixed topology with daisy chain and DMX out

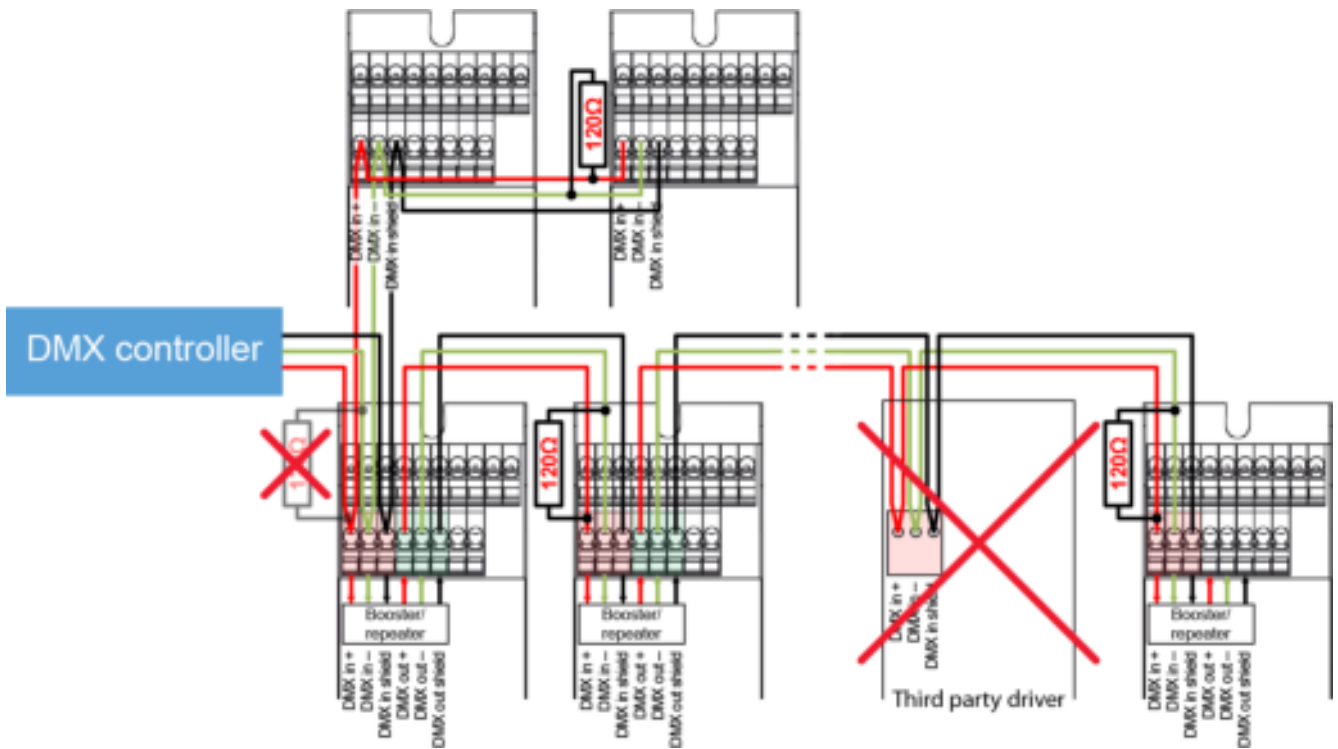


Figure 7 – It is not possible to have third party drivers in the DMX out-chain

## Why choosing the right cable is important

### External disturbances

DMX is a balanced three wire system. Two wires carry the data signals and one wire acts as common reference. The advantage of a balanced system is that external disturbance signals (EMI or electromagnetic interference) can easily be reduced. Both signal lines in a balanced system carry the same signals with opposite polarity which are subtracted from each other at the receiver (driver).

DMX cables should have twisted pair conductors. This means that each pair of wires in the cable are twisted together. This ensures that any external disturbance signal will occur equally on both signal wires (DMX in + and DMX in -). Since the receiver subtracts signals on both wires, the equal disturbance signals will also be subtracted from each other and are cancelled out.

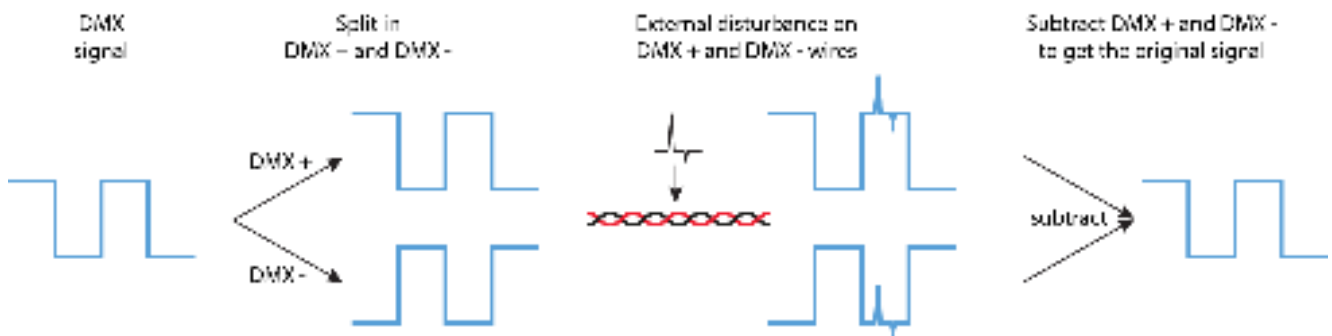


Figure 8 – EMI reduced with balanced system

The use of a shielded cable can further reduce EMI effects. The shield prevents external disturbances from reaching the signal wires. If a shielded cable is used, do not connect the DMX shield to mains ground.

### Reflections

DMX works with high frequency signals. In an unterminated cable, these signals will be reflected when they reach the end of the cable. These reflections can cause erratic behaviour like random flashing of lights, wrong brightness levels, etc.

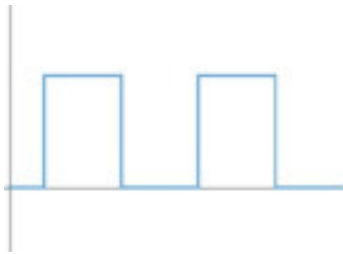


Figure 9 – Ideal signal



Figure 10 – Signal with reflections

To get the most reliable operation with minimal or no reflections, DMX cables should have an impedance of 120Ω as described in the DMX512 standard. Cable designed specifically for DMX (or RS-485) applications is readily available and also contains a shield wire – for instance, Belden 9841 cable. In some installations Cat5 or Cat6 UTP cable can also be used. At the last driver, the cable must be terminated with a 120Ω resistor to prevent reflections. Signal loss

Long wires always cause some signal loss due to the resistance of the cable. Therefore, the maximum cable length between the controller and the last driver must be less than 300 metres.

There is also signal loss because of the loading of the connected drivers. The DMX512 standard states that a maximum of 32 unit loads can be connected to one DMX cable. LED drivers are one unit load. If the total unit load exceeds 32, a splitter, repeater or booster can be used. Note, however, that repeaters, boosters and splitters may also add to the total unit load.

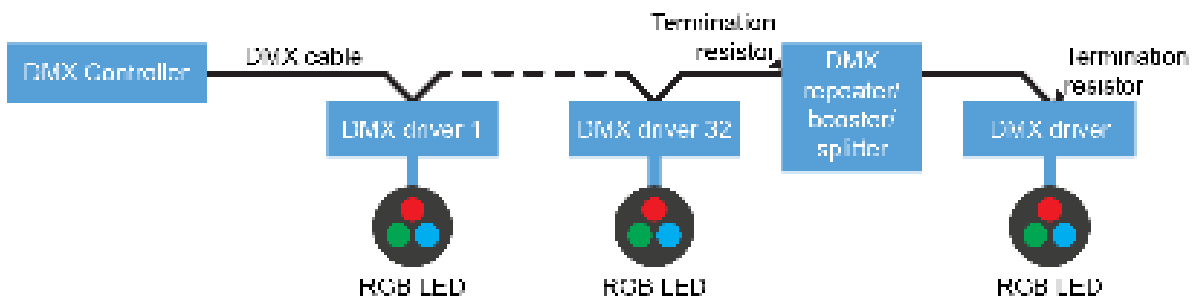


Figure 11 – More than 32 unit loads

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## Summary of best practices

- Use twisted pair cables with an impedance of 120Ω and a low capacitance.
    - UTP Cat5 or Cat6 network cable can also be used but have a slightly lower impedance of 100Ω.
  - Terminate at the last driver with an impedance of 120Ω.
  - If shielded cable is used, only connect shield to ground on one side (typically, the controller should have its shield terminal connected to ground).
  - DMX is designed to use three wires.
  - Not following the above recommendations may seem to work at first, but can cause problems. Sometimes after weeks of seemingly normal operation.
-