REV 1.7

CoolLED pro LED DRIVERS

CLi15 (15 watt)

0-10V / 1-10V Analogue Dimmable

15W (up to 1050mA)

The all new CLi LED driver range from Harvard uses uniquely developed technology solutions to achieve high dimming accuracy, safety and reliability in an ultra slim compact format.

This new addition to the CoolLEDpro range offers low dimming to 0.1%.

The drivers include a range of programmable dimming features, achieving an ideal lighting performance.

The exceptionally low flicker performance over the full operating range means the CLi range can suit the most demanding applications.

- Ultra Compact - Fits through a 40mm hole.
- Support for 1-18 LEDs.
- Isolated output.
- Fully isolated dimming interface.
- Programmable current available.
- Smooth logarithmic dimming to 0.1%
- Low inrush current
- Exceptionally low LED flicker. Near perfect light quality.
- Power Factor corrected
- DALI version available (see separate datasheet)
- Designed in the U.K. Manufactured in India.

Technical Highlights

- Fully programmable in 1mA step increments
- Less than 1% flicker at 100Hz/120Hz - Meets IEEE1789:2015 'No Effect' Region 1Hz to greater than 2kHz
- Minimum dimming of 1mA - 25 bit dimming resolution
- Small size 21mm x 39.5mm x 133mm (149mm remote version)
- Input voltage range 220-240V
- Remote mount version (order end caps separately)
- Up to 15 Years Operation (See Driver lifetime graph for more details)
- Extensive hot plug protection (low output capacitance and additional software protection features)
- Up to 85% efficiency
- Power factor corrected (0.97)
- Operation up to 50°C ambient
- Supports a large LED string voltage range, 2V to 38V or 4.5V to 52V (model dependent)

- Self-resetting thermal trip
- Mains to LED output: Reinforced isolation 3kV
- 0-10V/1-10V to Mains: Reinforced isolation 3kV
- 0-10V/1-10V to LED output: Reinforced isolation 3kV
- 100% - 0.1% dimming
- DTO (Smooth dim to off option with two programmable level choices)
- Logarithmic dimming
- Three other dimming curve options
- Surge protection 2kV Differential, 4kV Common mode

LOW Flicker | 0-10V 1-10V | analogue dim

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CoolLED PRO

LED DRIVERS

Technical Specification

	A01			A02		
Mains input voltage	220 to 240VAC Nominal					
DC input voltage	220 - 240V Nominal / 176 -280V Operational range					
Input Current	0.1A					
Input Power	19W Max					
Emergency supply currents	@220VDC - 83mA (±10%) / 240VDC - 76mA (±10%)					
Driver emergency output factor (EOF_l)	1.00 (Light output on AC or DC supply is identical					
Mains frequency	0/50/60Hz					
100/120 Hz ripple	<1%					
Flicker	IEEE1789:2015 compliant with NO RISK category					
Mains surge protection	4kV common-mode 2kV differential-mode					
Input-output isolation	3kV AC rms					
Mains inrush current	25A peak decaying to zero over 30µS (0.1R + 100µH mains impedance)					
Number drivers per MCB (maximum typical)	B6	B10	B16	C6	C10	C16
	35	60	100	45	75	120
Output protection	Overvoltage, short, reverse polarity. Auto re-start					
Hot plug protection features	low output capacitance <9µF, current limiting and software restart features					
Input current THD	8% typical @ full load					
Mains harmonics	IEC/EN61000-3-2 Class C limit, Table 2					
Touch Current (LED output)	0.28mA (spec limit is 0.7mA) @ 240V mains EN60990					
Touch Current (0-10V/1-10V)	<50µA					
Dimmer supply current	330µA typical					
Humidity	85% max non-condensing					
EMC emissions	Meets EN55015:2013. Conducted (9kHz-30MHz), Radiated (30MHz-300MHz)					
'Cold' start-up time	250ms typical					
Off load voltage	A01: <46V			A02: <60V		
Ambient temperature range	-25°C to 50°C (Any orientation)					
Maximum Tc temperature	80°C					
Thermal trip	100°C (Self-resetting)					
Dimming range	100 - 0.1% (1mA Minimum)					
Programmable current range	100 - 1050mA (±5 %)			100 - 700mA (±5 %)		
LED string voltage	A01: 2.5V - 38V			A02: 4.5V - 52V		
Max power	15W					
Power factor	0.97					
Efficiency	85%					
Terminal blocks	45° Push fit connectors, Input: 3.5mm pitch, Output/0-10V: 3.5mm pitch					
Enclosure	White polycarbonate UL94-V0 rated					
Wire size	0.5mm² to 1.5mm²					

Case Style	Dimensions	Weight	Box Quantity	IP Rating
Integral	133.3mm x 21mm x Ø39.5mm	92g	24	N/A
With cable clamps	149mm x 21mm x Ø39.5mm	100g	24	IP40

Operation

*Drivers are suitable for DC & AC operation at 0/50/60 Hz and compliant to EN50172.
The operation is compliant to EN 60598-2-22 except with the 'high risk task lighting' applications.

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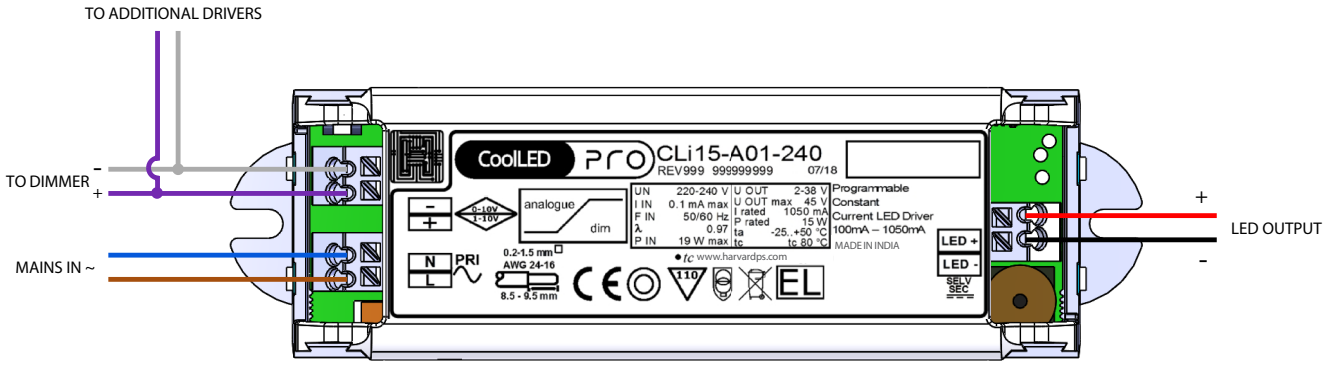
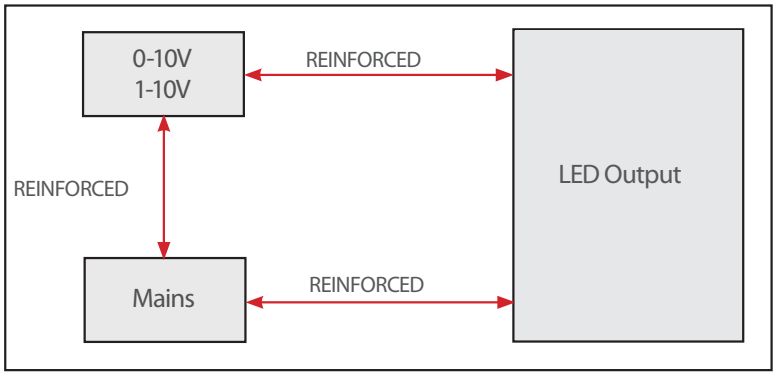
CLi15 Analogue Dimming LED Driver - Wiring Diagram

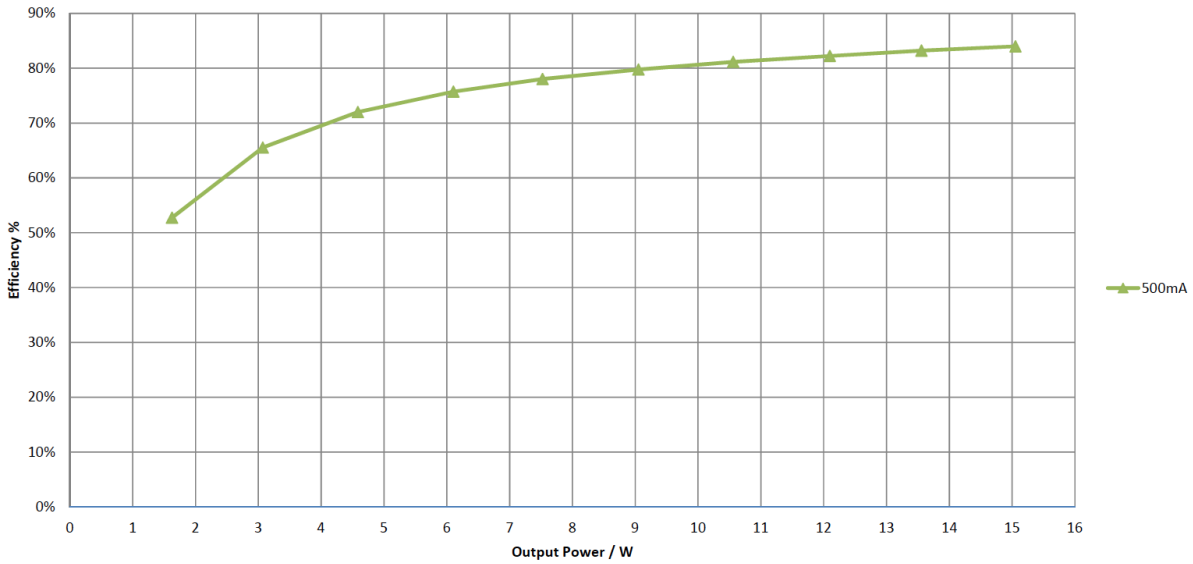


Insulation classes for isolated circuits

CLi analogue model isolation barrier definition



Efficiency



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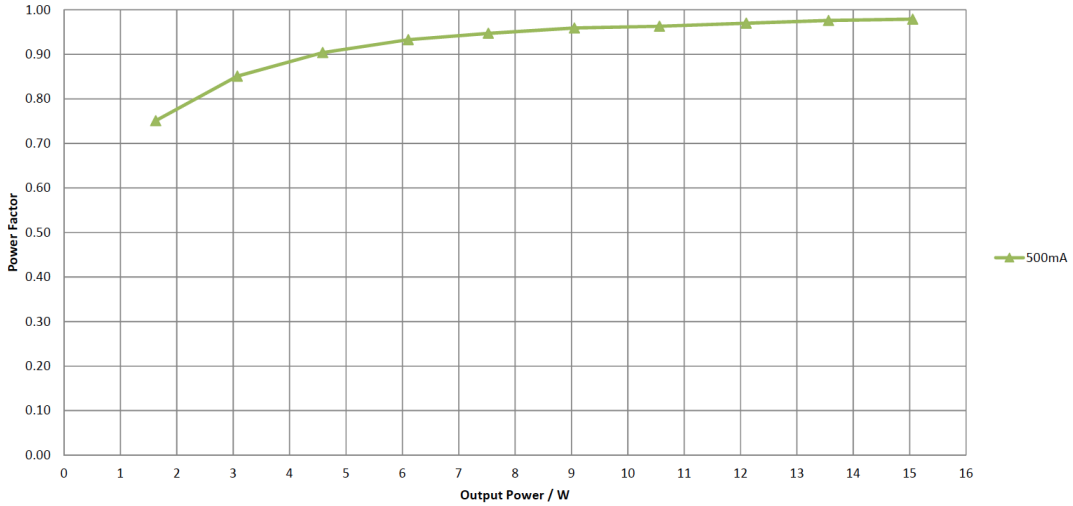
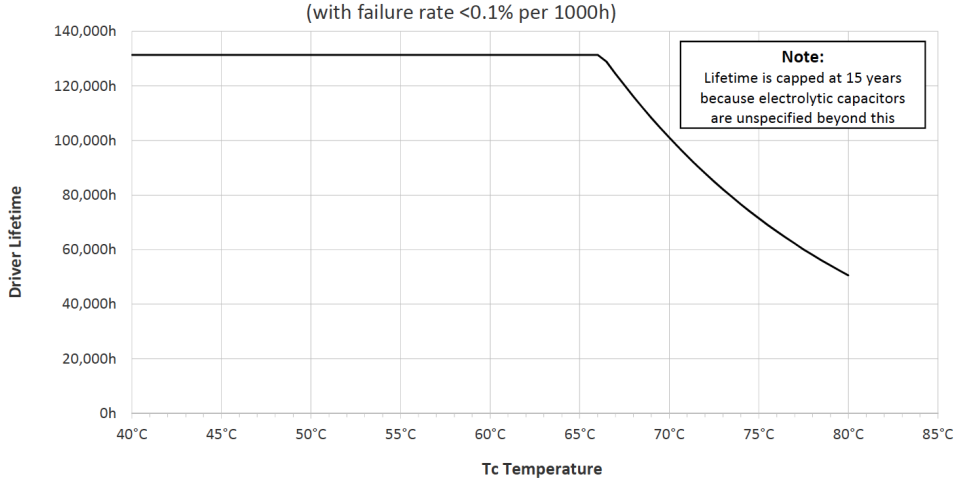
Power Factor

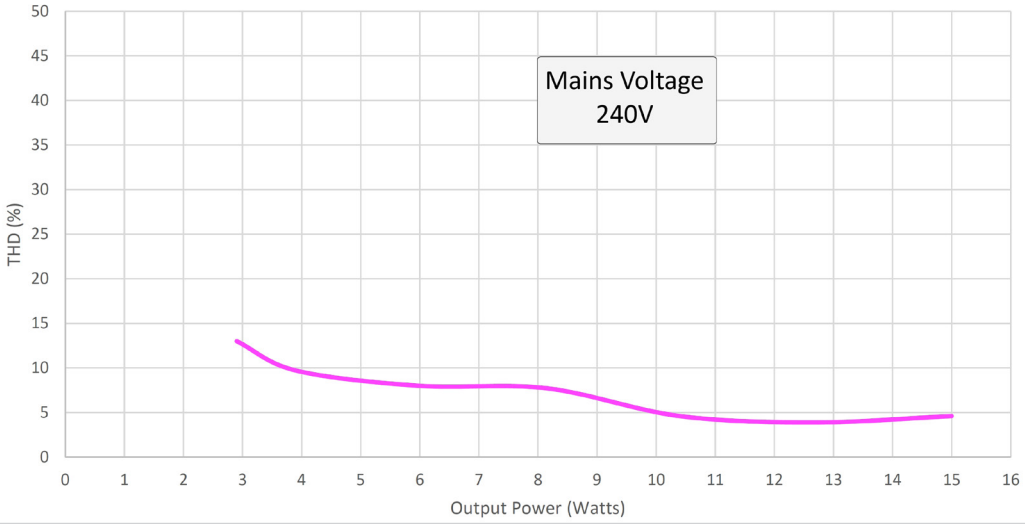


Driver Lifetime with Temperature at Full Load

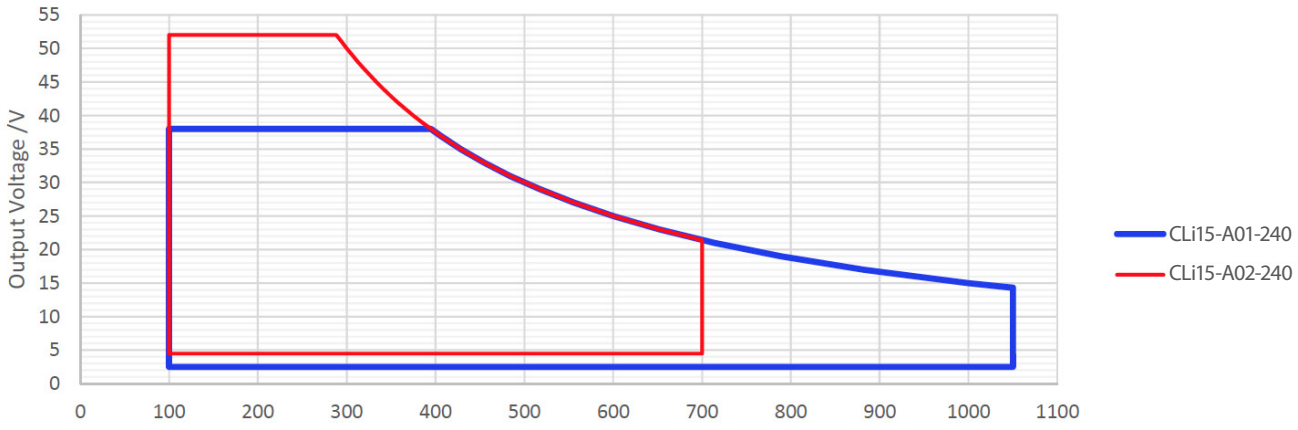
(with failure rate <0.1% per 1000h)



THD vs Output Power

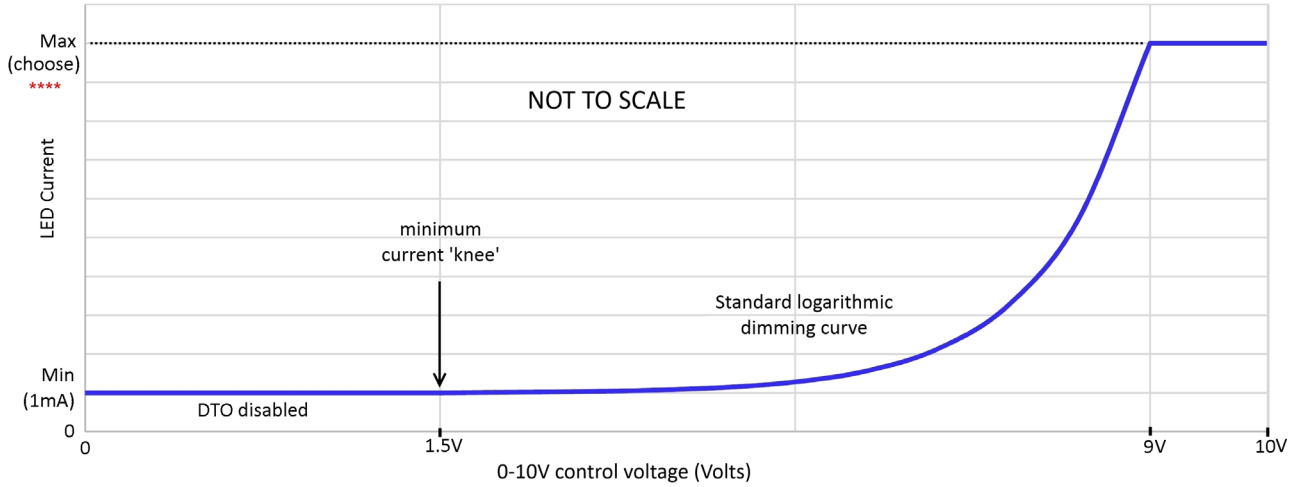


Operating Range (undimmed)



LED constant current is set in software according to application/customer requirement.

CLi15 Analogue dimming LED Driver: Default dimming control curve (No A,B or C options specified)



CoolLED PRO LED DRIVERS

Variants

Part number	Programmable Current Range	LED String Voltage	Max. Tc Temperature	Ambient Temperature Range	Thermal Trip (Self - resetting)	Maximum Power	Power factor at full load	Efficiency at full load
CLi15-A01-240/xxxx	100 - 1050mA* (±5%)	2.5V to 38V	80°C	-25 - 50°C	100°C	15W	0.97	85%
CLi15-A02-240/xxxx	100 - 700mA* (±5%)	4.5V to 52V	80°C	-25 - 50°C	100°C	15W	0.97	85%

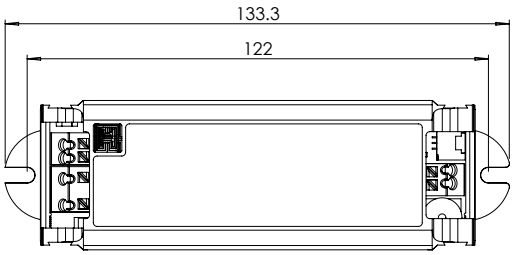
*Minimum dimmed current is 1mA

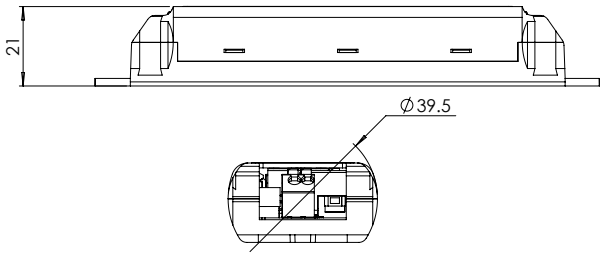
Product part number example:
Customer requirement= 3 LED (9V) 1000mA current. Power is 9 watts. Default features: No DTO, Log dimming curve, 1mA minimum dimming.
Product choice = A01 model programmed to 1000mA. Part number = CLi15-A01-240/1000

For other programmable options, See Page 7

Dimensions

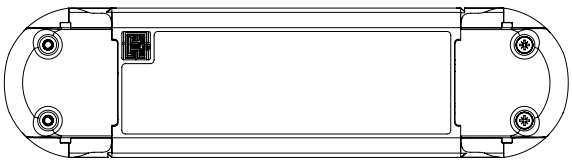
Integral style

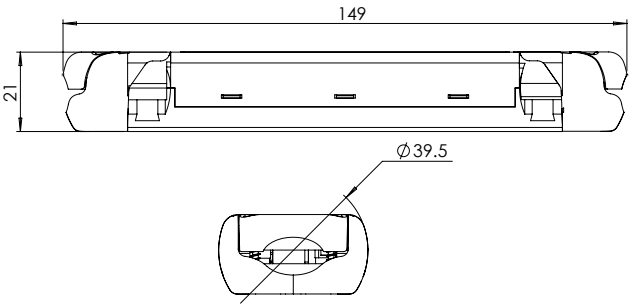




Cable clamps (remote) style

For remote mount, cable clamps are required
Order CLi15 clamp kit part number: CLI-CC39-SET





Compliance

Approval	Standards
CE (Europe)	LVD:2014/35/EU, EMC:2014/30/EU, RoHS:2011/65/EU, ECOD/2009/125/EC
ENEC (Europe)	EN61347-1:2015, EN61347-2-13+A1:2017+ANNEX J
CB (International)	IEC61347-1:2015, IEC61347-2-13+A1:2016+ANNEX J
RCM (Australia/NZ)	ASNZS61347.1:2016, ASNZS61347.2.13:2013, ASNZS-CISPR15, ASNZS4417.1:2012

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Additional programmable options

Dimming Defaults, Options and Part Numbering System

The CLi15 analogue dimming LED driver is fully programmable to match customer requirements.
Sensible default limits have been chosen which consider ease of adjustment and typical dimmer performance limits.
In certain cases, a customer may need alterations to the defaults. The following parameters can be adjusted:
Please note: Expert knowledge is required to define the correct configuration for the end user.

A. DTO (Dim To Off):

The Default is DTO disabled.

If Dim to off is enabled, below a certain control voltage the driver output is turned off and it goes into a low power mode (<600mW).
DTO can affect the Knee voltage range. Knee voltages are the two analogue voltages at which minimum and maximum current occur.

Programmable Options:

Low level DTO: Turns off at 0.5V, on at 0.8V. Dimming 'knee' voltages 1.5V to 9V

High Level DTO: Turns off at 1.3V, on at 1.5V. Dimming 'knee' voltages 2V to 9V

B. Dimming curve:

The Default is a Logarithmic curve (Closely matches human luminance perception and allows precise light control)

Programmable Options:

Soft-logarithmic, Linear and Soft-linear (see performance curves on next page)

C. Minimum dimmed current:

Default is 1mA minimum

Programmable Options:

The minimum dimmed current can be programmed to customer requirements over the range 1.05mA to 99.95mA in 0.05mA steps.
Note: If linear dimming curve is specified, the minimum dimming may need to be increased significantly to maintain good adjustability.

Note: Analogue Dimmer types

1. Passive dimmer (variable resistor). These are simple but imprecise and care is required in choosing the correct value resistance for the number of drivers being controlled. Adequate for general use. If DTO is required, Low Level DTO is recommended.

2. Electronic dimmer which is powered from the 0-10V terminals. These have variable performance, typically they cannot reduce the control voltage to less than 1V. If DTO is required, High Level DTO option is recommended.
Recommended dimmers: Varilight FQP1M1W or MFP1M1 / Aurora AU-DSPLED (1 to 20 drivers for either type recommended)

3. Electronic dimmer which is mains powered. These types should offer the best performance and be capable of reducing the control voltage close to 0V. If DTO is required, check dimmer performance before specifying DTO type (High or Low).

Extended Part Number System

In most cases the end user only has to specify the maximum current which is a 3 or 4-digit number (mA) added to the model number.

Up to 3 additional options adds extra suffix(s) to the part number.

Note: LED string voltage should always be less than the driver maximum voltage and power capability. A01 model max is 38V. A02 model max is 52V.

Minimum dimmed programmable current range is 1mA to 99.95mA in 0.05mA steps

			Extra Options		
			A	B	C
Base Model		Programmable current range	DTO (Dim to off)	Dimming curve	Minimum dimmed current
CLi15-A01-240	/	100-1050 (mA) 3 or 4 digit number 1050mA (default)	Empty (No DTO) A1 (Low level) A2 (High level)	Empty: Logarithmic (default) B1: Linear B2: Soft Linear B3: Soft Logarithmic	Empty 1mA (default) C**** **** = Programmed min current
CLi15-A02-240	/	100-700 (mA) 3 digit number 700mA (default)	Empty (No DTO) A1 (Low level) A2 (High level)	Empty: Logarithmic (default) B1: Linear B2: Soft Linear B3: Soft Logarithmic	Empty 1mA (default) C**** **** = Programmed min current

Minimum dimmed current code examples: 1.25mA = C0125, 55mA = C5500, 99.95mA = C9995

Product part number example:

Customer requirement= 3 LED (9V) 1000mA current. Power is 9 watts. Default features: No DTO, Log dimming curve, 1mA minimum dimming.
Product choice = A01 model programmed to 1000mA. Part number = CLi15-A01-240/1000
Customisation to this product:

- Add high level Dim To Off = CLi15-A01-240/1000A2
- Change dimming curve to Soft Logarithmic = CLi15-A01-240/1000A2B3
- Set minimum dimmed current to 1% of programmed maximum = 10mA = CLi15-A01-240/1000A2B3C1000

Note: To add cable clamps: order CLi15 clamp kit part number: CLI-CC39-SET

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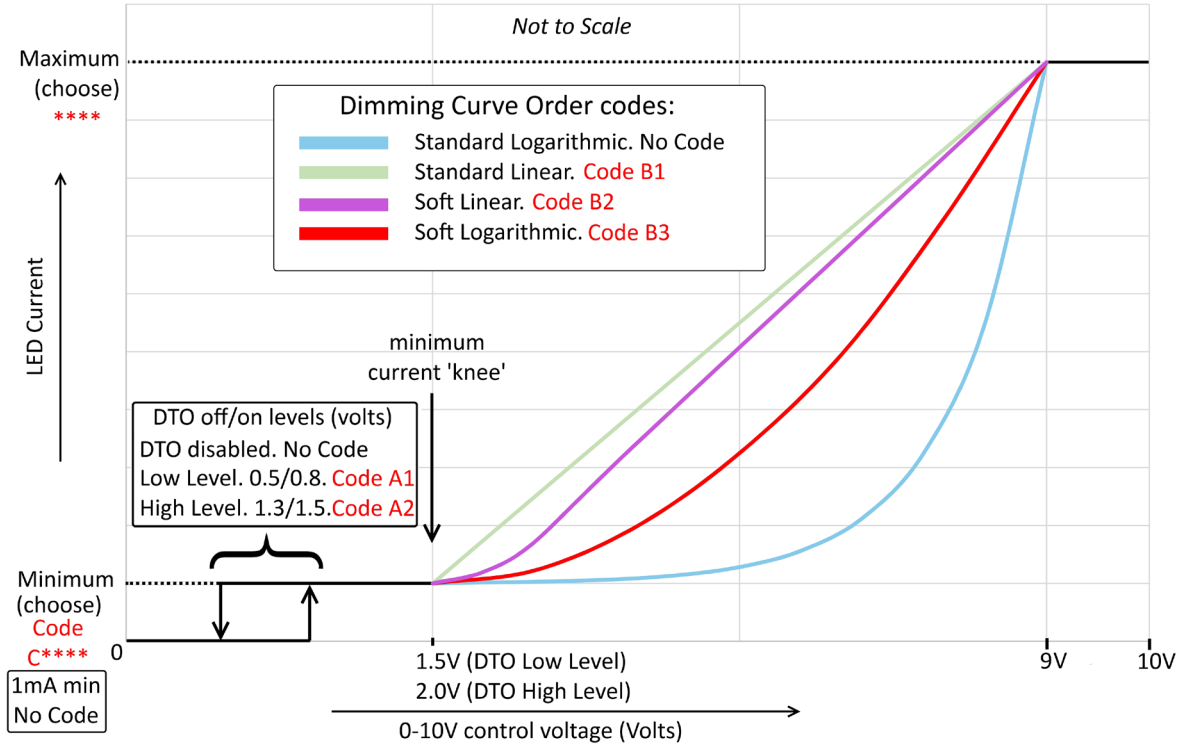
CLi15 Analogue Dimming LED Driver. Programmable dimming options (A, B & C)



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