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# Product Specification

CLSD-020-PRG-G2

10W-20W LED Dimmable Driver

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## 1 General

CLSD-020-PRG-G2 is a 10-20W programmable and dimmable LED driver with a wide output current range. The driver can be dimmed either by a PWM (Pulse Width Modulation) signal or by a 0-10V dimmer. Also an Off-State is implemented which can be entered by PWM dimming control. Due to its digital control various settings can be programmed by the user. Programming requires the use of the CLSD-PRG-BOX-G2 Programming Box plus NMB's LED Driver Set-up Application Software. Figure 1 shows the topology of the LED driver.

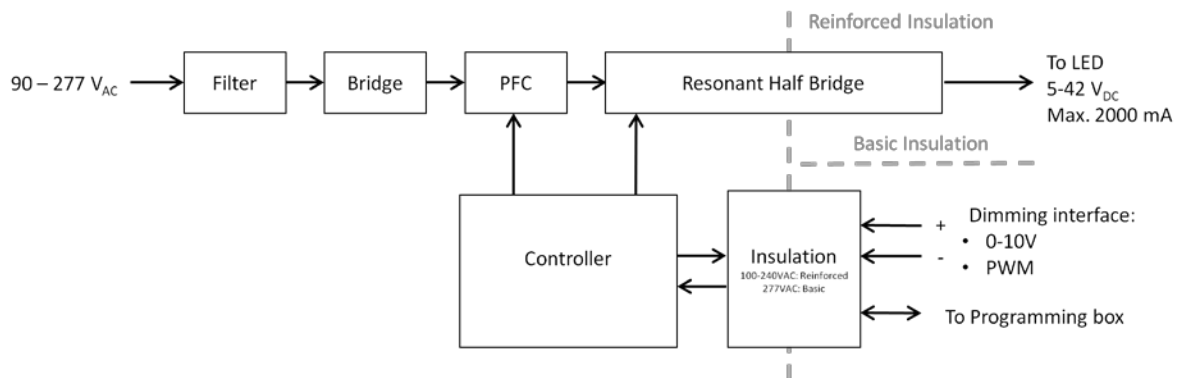


Fig.1: Block diagram of LED driver

## 2 Electrical Characteristics

The Figure 2 shows the operating area of the LED driver.

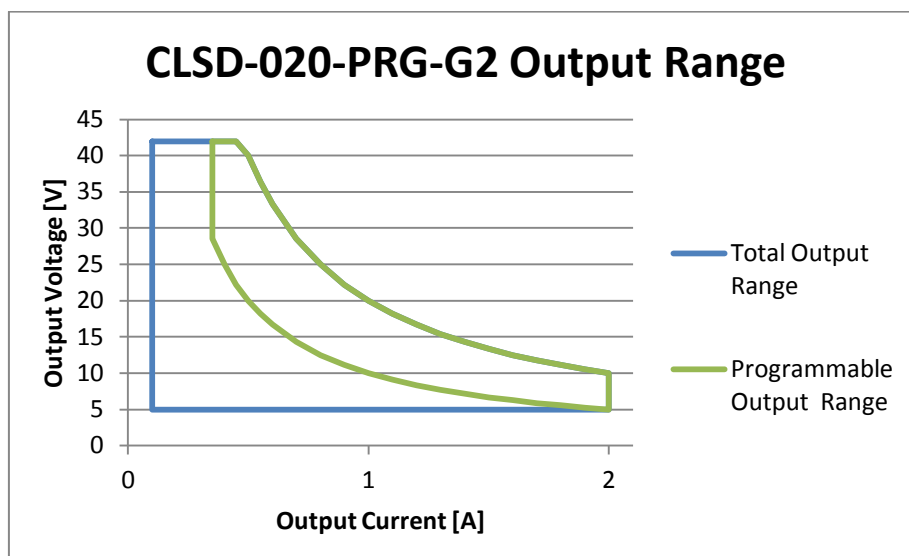


Fig. 2: Operating area

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Parameters are given for maximum rated power and 25°C unless otherwise specified.  
 Stresses exceeding the absolute maximum ratings may damage the device.

Parameter	Condition	Spec			Unit
		Min.	Typ.	Max.	
Input RMS Voltage	Maximal range	90	-	305	V
	Operating range	100	-	240	V
	Operating range for North America only	100	-	277	V
Mains Frequency	-	-	60/50	-	Hz
Maximum Total Harmonic Distortion of the Input Voltage	-	-	-	5	%
Input RMS Power	-	-	-	26	W
Off-State Power Consumption	-	-	-	0.5	W
Input RMS Current	-	-	-	0.3	A
Inrush Peak Current	$V_{in}=277V$	-	-	36	A
Power Factor	-	0.90	-	-	-
Output Current	Programmable	0.35	-	2.0	A
	With Dimming	0.10	-	2.0	A
Output Current Tolerance	-	-	±5	-	%
Output Voltage Ripple <sup>1</sup>	-	-	-	0.45	V
Output DC Voltage	-	5	-	42	V
Output Power	Without Dimming	10	-	20	W
Efficiency		-	90	-	%
Start Time		-	-	1	s

<sup>1</sup> Ripple voltage is measured at 20MHz of bandwidth and terminating the output with a 0.1µF ceramic capacitor and a 10µF Al-capacitor in parallel.

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### 3 Dimming

The dimming interface can be used for 0-10V and for PWM signals. It is compliant to IEC60929 as well as to ANSI E1.3. The LED driver is set to Off-State if a PWM-signal with duty cycle >95% is applied to the dimming interface.

The dimming characteristic for 0-10V dimming can be programmed by the user (see Section 4.4). The default characteristic is shown in Fig. 3. The dimming curve for PWM dimming is shown in Fig. 4. The dimmed output current is limited to 100mA (see Section 2).

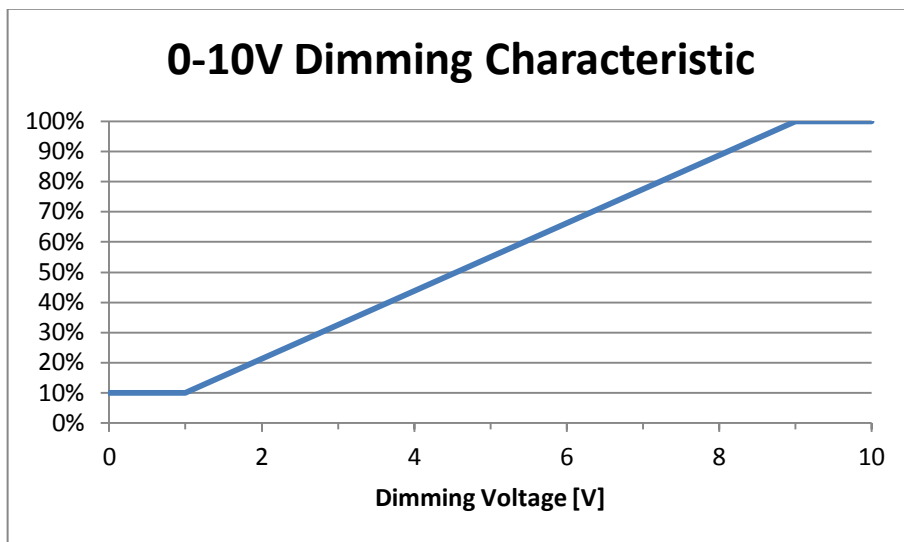


Fig.3: Typical 0-10V dimming graph

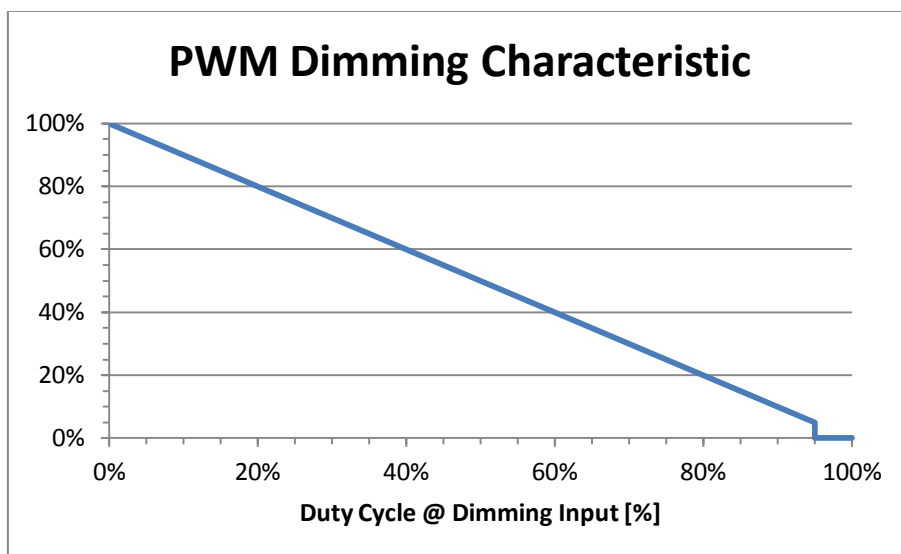


Fig.4: Typical PWM dimming characteristic

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Parameter	Condition	Spec			Unit
		Min.	Typ.	Max.	
Min. Dimming Ratio	0-10V	-	10	-	%
	PWM dimming	-	0	-	%
0-10V Voltage Level Range	0-10V	0	-	10	V
0-10V Input Current	0-10V	10	-	2000	μA
PWM Voltage	PWM Low Level	0	-	1.5	V
	PWM High Level	10	-	25	V
PWM Frequency	PWM dimming	100	-	1000	Hz

## 4 NMB's LED Driver Set-Up Application Software

Programming the LED driver requires the use of the programming box CLSD-PRG-BOX-G2 and NMB's LED Driver Set-Up Application Software. Driver installation, Programming instructions, and support are available at: <http://www.nmbtc.com/lighting/support>.

System requirements:

- Windows XP (32 bit)
- Windows Vista
- Windows 7
- Windows 8
- Microsoft.NET Framework 4.0

The programming utility contains four tabs for various LED driver settings:

- Programming
- Brightness Compensation
- Diagnostics
- Dimming Selector

The LED driver must not be connected to mains while programming. Programming will also not work if the dimming interface is not open circuited.

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#### 4.1 Programming

Figure 5 shows programming tab. After connecting the LED Driver via the programming box to the PC, the LED Driver is automatically detected and displayed in the 'Driver specification' block. Also the actual settings are read and shown in the 'Driver Settings' block.

The desired output current value can be entered by using the text field or the slider in the 'Current Configuration'. The corresponding admissible LED voltage range is shown below automatically.

Besides the output current setting also the dimming methods and protection settings can be set in the block 'Advanced Configuration'. The dimming control method can be chosen (0-10V / PWM) or be de-activated. The default values of 'Over Temperature' and 'Overvoltage' limitation can be reduced.

The File menu allows to save the current settings to a file and to load previous settings. The Help menu provides a help file with brief descriptions of all fields.

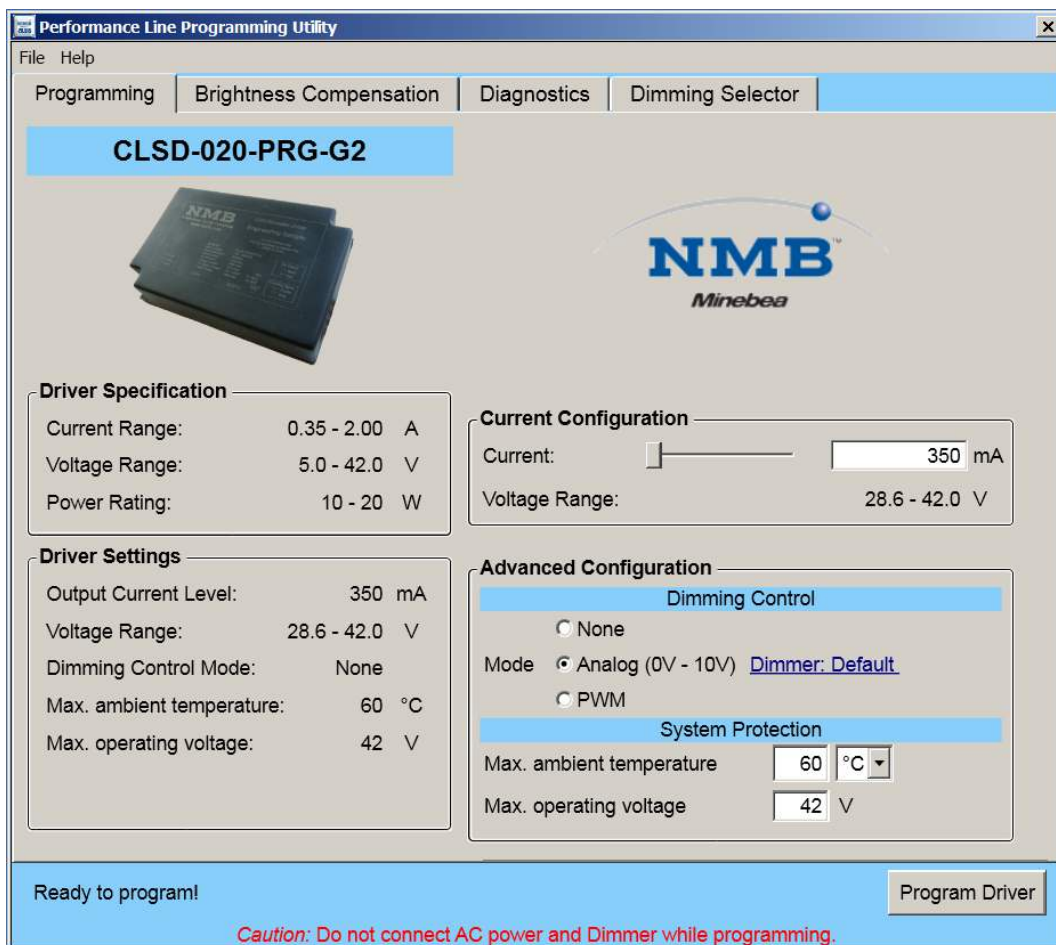


Fig. 5: LED Driver Programming Utility – Programming Tab

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## 4.2 Brightness Compensation

In order to compensate the reducing LED brightness over its operating time the output current of the driver can be increased over its operating time. Figure 6 shows the curve editor of the Brightness Compensation tab.

- Adding a point: A point can be added simply by clicking on the desired location in the diagram.
- Modifying a point: A point can be modified by clicking the left mouse button on it, holding the left mouse button and then moving the point to the desired location.
- Deleting a point: A point can be deleted by using the context menu when clicking the right mouse button on it.
- Deleting all points: All points can be deleted by using the “Edit” menu

In the initial setting the output current ratio is set to 100% for all operating hours.

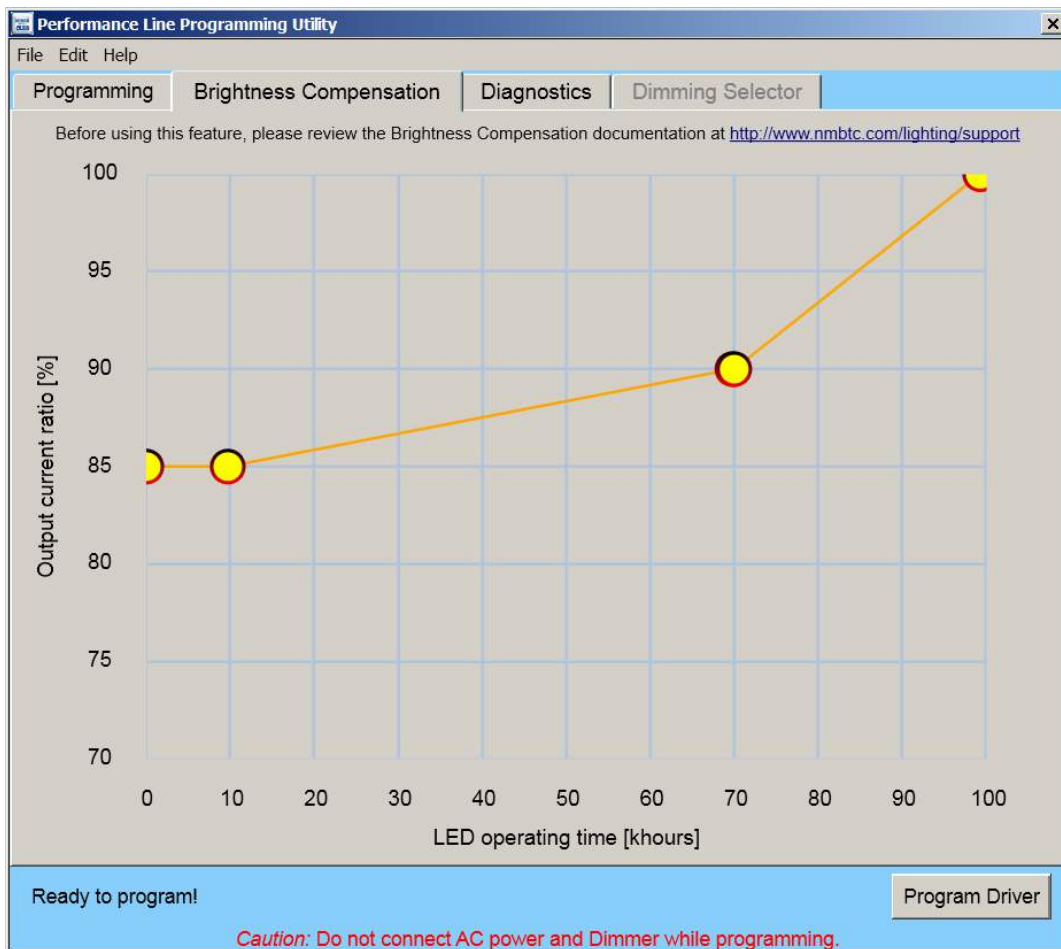


Fig. 6: Brightness Compensation curve editor



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### 4.3 Diagnostics

The driver also stores its operating hours and the number of error occurrences as shown in Fig. 7. The LED operating time and the error occurrences can be reset – e.g. when a new LED module is connected to the driver. But the driver operating hours are of course not resettable.

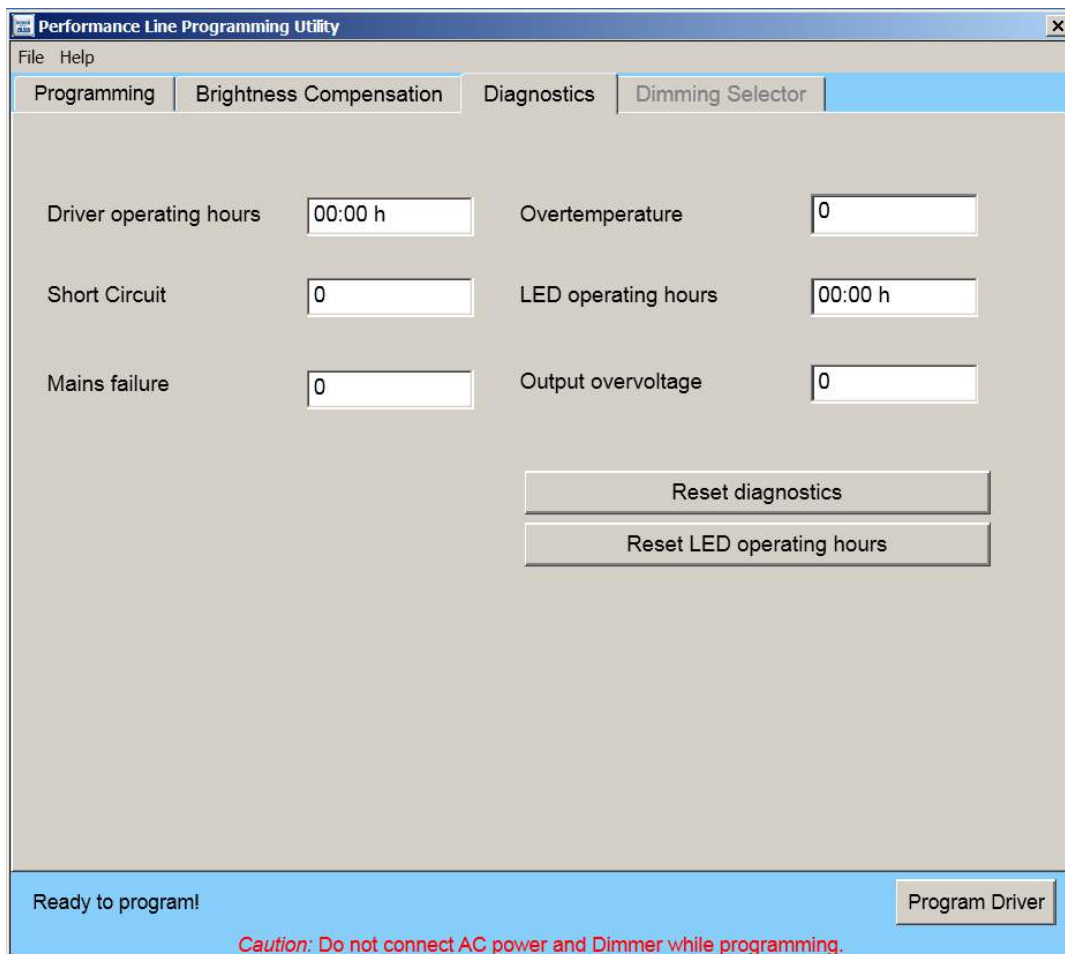


Fig. 7: LED Driver Programming Utility – Diagnostic tab

### 4.4 Dimming Selector

When using a 0-10V dimmer, the dimming characteristic can be modified according to the used dimmer. Commercial dimmers are usually consisting of a variable resistor and additional protection functions. Unfortunately the resistance ranges are not standardized. Thus each dimmer has its own resistance range. In order to match the dimming interface of the driver to the used dimmer, the dimming characteristic of the CLSD-020-PRG-G2 can be programmed by the user. The Dimming Selector tab allows the user to choose between several commercial dimmers (see Fig. 8). Alternatively the default characteristic (Fig. 3) can be chosen. If the used dimmer is not listed on this tab a user-defined curve can be entered.

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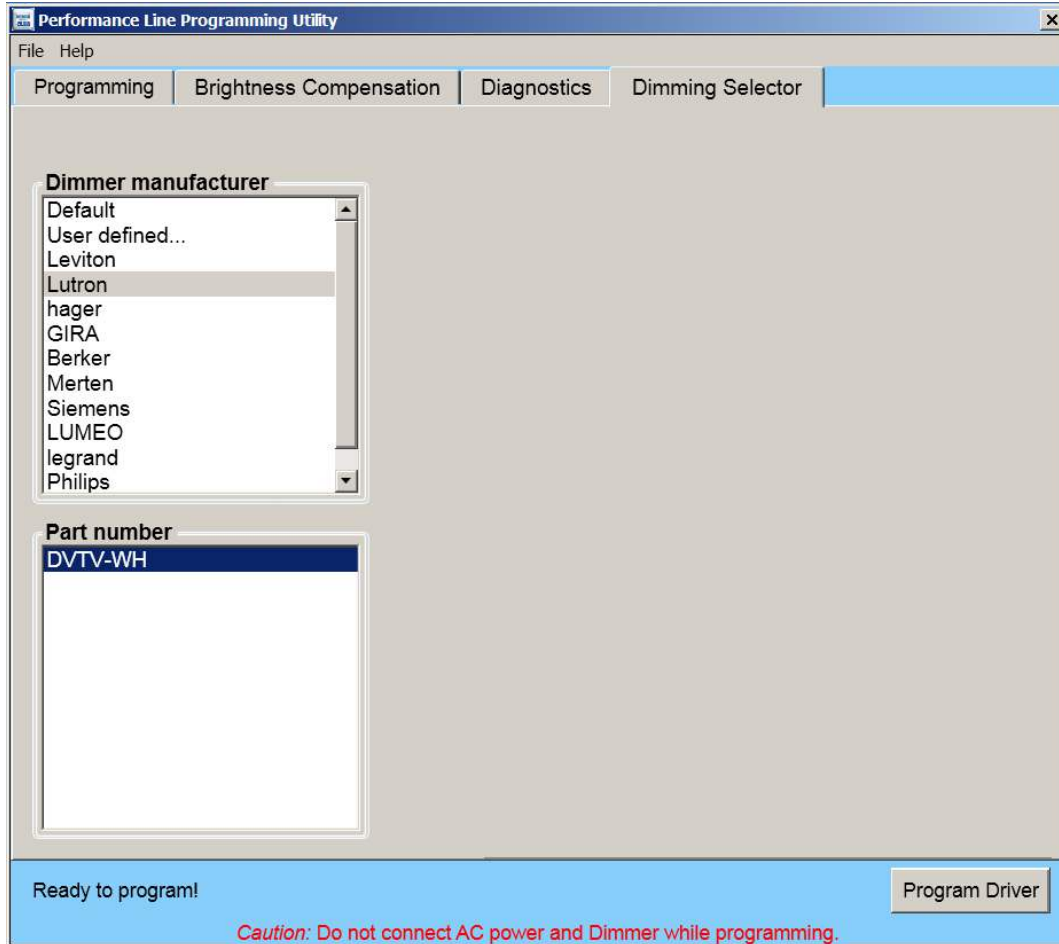


Fig. 8: LED Driver Programming Utility – Dimming Selector tab

The minimum and/or maximum resistance value of most commercial dimmers can be set by an internal potentiometer (the user can set it by either using a screw driver or by a trimpot wheel). In order to make best use of the dimmer these should always be set such that the resistance range is maximized (minimize “Min” value and maximize “Max” value – please see the manual of the corresponding dimmer). The dimming characteristics implemented in the programming utility always require that this is done.

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## 5 Protection Functions

CLSD-020-PRG-G2 provides protection functions in order to prevent itself and its application from damage. In case of any abnormal operation is detected the driver shuts down and restarts after 5s.

<b>Ingress protection</b>	IP20
<b>Short circuit protection</b> (Resistor<0.3 Ohm)	The driver is turned off and restarts after 5s automatically.
<b>No load operation</b>	The driver is turned off and restarts after 5s automatically. Thereby the maximum output voltage is limited to below 50V.
<b>Over temperature protection</b>	Over temperature is detected by a thermistor on board. The over temperature shutdown value can be reduced by the user. If this value is exceeded driver is turned off and restarts after 5s automatically.
<b>Over voltage protection</b>	Over voltage protection is triggered when the output voltage exceeds 110% of the maximal admissible output voltage (see Fig. 2). This value can be reduced by the user. If its exceeded the driver is turned off and restarts after 5s automatically.
<b>Over load protection</b>	The output power is limited to 25W. If its exceeded the driver is turned off and restarts after 5s automatically.

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## 6 Safety/ EMI/ Environmental/ Reliability Standards

### 6.1 Safety Standards

<b>Protection class</b>	II
<b>Safety requirements</b>	UL8750, UL60950, UL1310 Class 2 Output (NEC Class 2), CSA C22.2 No 107 , CSA C22.2 N0.223, EN 60335-1, EN61347-1, EN61347-2-13
<b>Test Reports</b>	UL Report, CB-Report/CE-Report
<b>Safety Marks (on the product)</b>	CE-Mark, UL, cUL, ENEC

### 6.2 EMC Requirements

<b>EMC Standard</b>	FCC Part 15 Class B, EN 55015 Class B
<b>Harmonic current</b>	EN 61000-3-2:2006 Class C
<b>Flicker</b>	EN 61000-3-3: 2000
<b>Immunity</b>	EN 61547: 2009
<b>Surge voltage</b>	EN 61000-4-5 2kV AC input lines
<b>Fast transients</b>	EN 61000-4-4 2kV AC input lines

### 6.3 Reliability/ Quality Requirements

<b>MTBF</b>	> 100.000 h according to MIL 217f at 25°C ambient temperature
<b>Product Life</b>	48 000h at 60°C ambient temperature 130 000h at 45°C ambient temperature

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## 6.4 Environmental Requirements

### 6.4.1 Climate specification

Parameter	Condition	Spec		Unit
		Min.	Max.	
Storage Temperature	Storage Humidity: 95 %RH	-40	85	°C
Storage Humidity	Storage Temperature: -40 to 85 °C	5	95	%RH
Operating Temperature	-	-25	60	°C
Case Temperature	-		90	°C

### 6.4.2 Vibration specification

The power supply will survive without any damage if the SSL converter is submitted to the following test conditions:

<b>Shock</b>	Pulse shape : half sine Acceleration: 300 m/s <sup>2</sup> Duration: 11 ms Direction: Three axes The number of times: 3 times each (total 18 times) Time between pulse: 3s
<b>Vibration</b>	Frequency: 5 ~ 55 Hz (5 ~ 10 Hz: 1.5 mm), (10 ~ 55 Hz: 29.4 m/s <sup>2</sup> ) Sweep rate : 1 Oct/min Direction: X, Y, Z 10 sweep for each axis (2 sweeps=1 cycle)

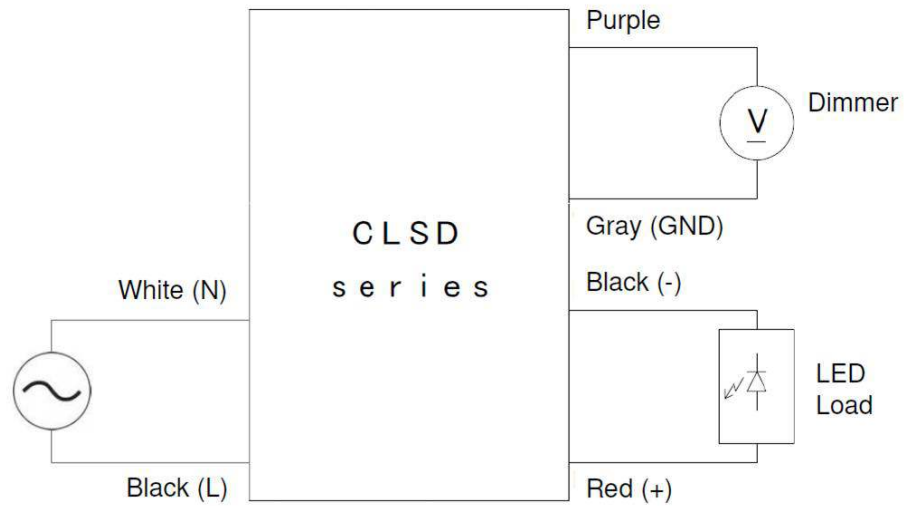
### 6.4.3 Green specification

<b>Green SSL driver</b> - <b>RoHS conform</b> (Restriction of hazardous substances)	The power supply meets RoHS (EU Directive 2002/95/EC). This means, the following material have to meet their threshold values in homogenous material: - Lead, mercury, hexavalent chromium, PBB and PBDE ≤ 0.1% by weight - cadmium ≤ 0.01% by weight
<b>WEEE</b>	Confirm EU Directive 2002/96/EC

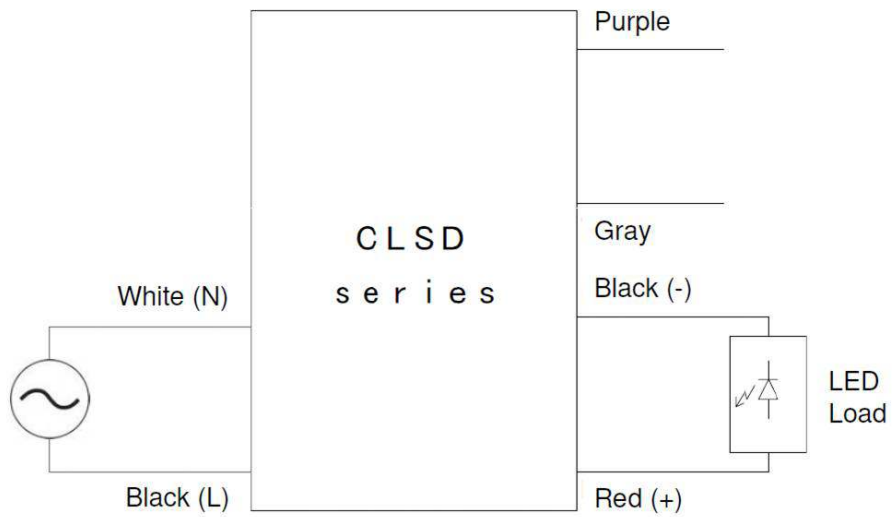
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## 7 Connections

The LED driver is equipped with wire-leads for input and output connection.



Connections with dimming



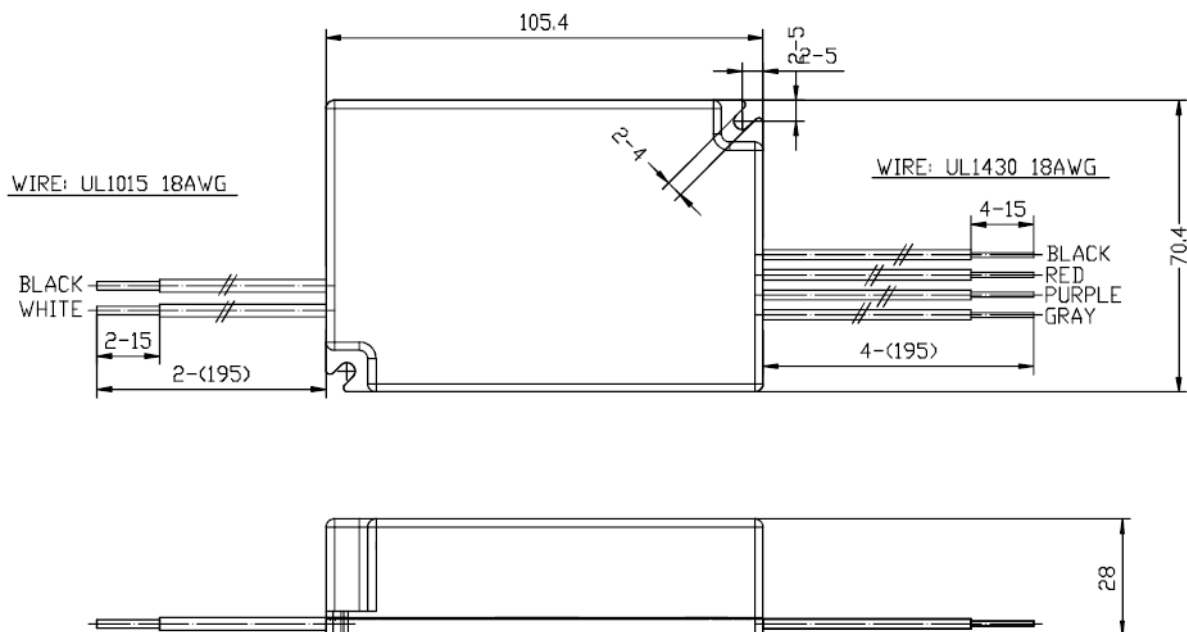
Connections without dimming

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## 8 Mechanical Dimensions

The LED driver has a plastic enclosure.

<b>Length</b>	105.4 mm
<b>Width</b>	70.4 mm
<b>Height</b>	28 mm

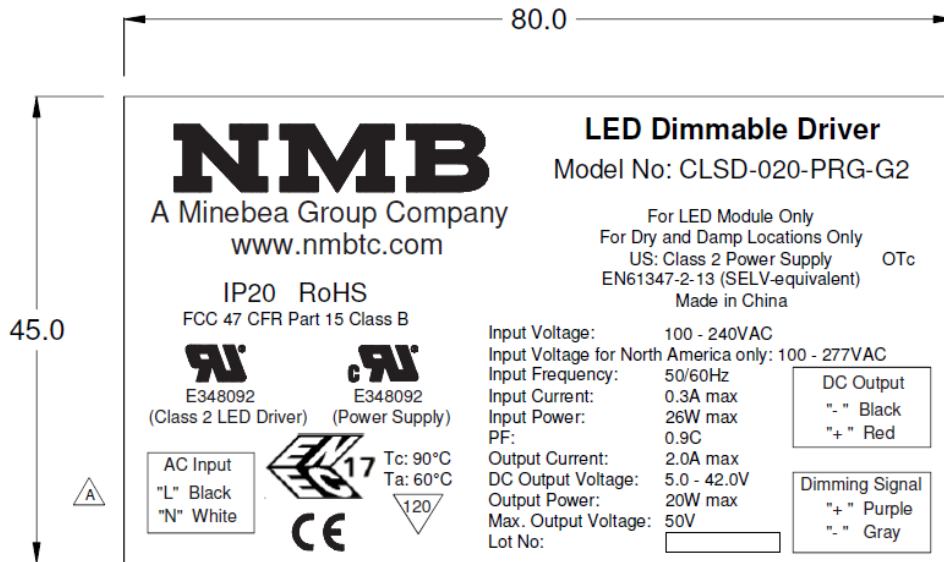


## 9 Weight

<b>Weight</b>	220 gr
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## 10 Label



## Revision History

Rev. Level	Date	Major Changes	Responsible
-	19.7.2013	Initial version	Oehmen
A	29.7.2013	Windows 8 support 305VAC max. input voltage -25°C min. ambient operating temperature Lifetime	Oehmen
B	23.8.2013	Dimming Selector Brightness Compensation	Oehmen
C	22.11.2013	EN60335 277VAC input voltage for North America Label	Oehmen
D	18.2.2014	Fig updated	Sherman