Aimtec's Lighting Solutions

2017

AIMTEC'S LED DRIVERS

Aimtec was the first power manufacturer to introduce LED Drivers that could operate at a bone chilling -55°C. Once again, Aimtec leads the way to succesful innovation and is introducing a new series of AC-DC LED drivers designed to be integrated in indoor or outdoor lighting systems. This new generation of LED drivers offers diferent options for easy integration by producing bright light with no fickering effect, as well as 3 ways for output current dimming (0-10V/PWM/Resistor), also available on models with Manual Output Current Adjustments.

The new AC/DC LED Driver product family offers a power range from 10W to 250W. All products operate with a universal Input Voltage Range of 90-264VAC or with an extended Universal Input Voltage Range of 90-305VAC. This new generation of LED Drivers come with Continuous Short Circuit Protection, Over Voltage Protection, Under Voltage lockout, Over Temperature Protection, Open Circuit Protection for safe operations and have low Total Harmonic Distortion. Series with over 25W are with Active Power Factor Correction.

Available in different packages and dimensions, plastic or metal cases with low height profile, these LED Drivers are rated from IP20 to IP67 and are suitable for diferent indoor or outdoor lighting applications.

OUTDOOR LED DRIVERS

Outdoor

SERIES	INPUT (VAC)	OUTPUT VOLTAGE (VDC)	OUTPUT CURRENT (A)	ISOLATION (VAC)	DIMMING	OPERATING TEMPERATURE (°C)	IP RATING	SAFETY
40 Watt								
AMER40-Z	90-305	30-42	0.75, 0.90	3750		-40 to +60	IP67	CE
AMER40N-Z	90-305	30-42	0.75, 0.90	3750		-40 to +60	IP67	CE
50 Watt								
AMER50-Z	90-305	30-42	1.05, 1.20	3750		-40 to +60	IP67	CE
AMER50N-Z	90-305	30-42	1.05, 1.20	3750		-40 to +60	IP67	CE
AMEQR50N-Z	90-305	36-50	1	3750		-40 to +60	IP67	CE
60 Watt								
AMER60-Z	90-305	24-42	1.3,1.4,1.5,1.6	3750		-40 to +60	IP67	CE
AMER60N-Z	90-305	24-42	1.3,1.4,1.5,1.6	3750		-40 to +60	IP67	CE
70 Watt								
AMEQR70N-Z	90-305	36-50	1.4	3750		-40 to +60	IP67	CE
90 Watt								
AMER90-Z	90-305	24-42, 40-56	2.0, 1.6	3750		-40 to +60	IP67	CE
120 Watt								
AMER120-Z	90-305	24-42, 40-56	2.5,3.0	3750		-40 to +60	IP67	CE
130 Watt								
AMER130-Z	90-305	35-55	2.4	3750		-40 to +70	IP67	CE
160 Watt								
AMER160-Z	90-305	15-48,30-55,15-48	3.2,2.9,3.4	3750		-40 to +70	IP67	CE
170 Watt								
AMER175-Z	90-305	15-48	3.6	3750		-40 to +70	IP67	CE
250 Watt								
AMER250C-Z	90-305	12-24, 21-42	5.0/10.0, 3.0/6.0	3750	3-in-1 dimming	-40 to +70	IP67	CE

FEATURES

Aimtec's outdoor AC/DC LED Drivers come with many features such as IP67 waterproofing, Accurate Constant Current ±5%, Ultra low ripple and no flickering for LED Drivers containing N in the series name. They also include Active Power Factor Correction and high efficiency up to 92%. Our new series have multiple safety features such as Continuous Over voltage, short circuit protection and have been designed to conform to EN55015, EN61000, EN61547 standards for optimal performance. Furthermore, select drivers have optional output current calibration potentiometers to allow more freedom to Solid State Lighting designers.

APPLICATIONS

Garage Lighting

Floodlighting

Streetlighting

Walkway Lighting

Low Bay Lighting

Outdoor Spotlights

INDOOR LED DRIVERS

Indoor

SERIES	INPUT (VAC)	OUTPUT VOLTAGE (VDC)	OUTPUT CURRENT (A)	ISOLATION (VAC)	DIMMING	OPERATING TEMPERATURE (°C)	IP RATING	SAFETY
5 Watt								
AMEPR5-AZ	90-264	3-5, 2-6, 5-12, 6-14, 6-16	0.3, 0.35, 0.7, 1	3000		0 to +80	IP67	CE
8 Watt								
AMEPR8D-AZ	90-264	9-18, 6-12, 12-24	0.35, 0.4, 0.7	3000		0 to +80	IP67	CE
10 Watt								
AMEPR10-Z	90-264	18-36, 23-33, 30-42	0.29, 0.24	3750	-	-20 to +50		CE
16 Watt								
AMEPR16-Z	90-264	24-42, 40-58, 30-42	0.29, 0.36	3750		-20 to +50		CE
30 Watt								
AMEPR30-Z	90-264	30-42, 28-42	0.5,0.6,0.7	3750		-20 to +50		CE
AMEPR30N-Z	90-305	24-42	0.5,0.6,0.7	3750		-30 to +50		CE
AMEPR30NC-Z	90-305	24-42	0.5,0.6,0.7	3750	3-in-1 dimming	-30 to +50		CE
40 Watt								
AMEPR40-Z	90-264	80-100, 30-42	0.4, 1.0	3750		-20 to +50		CE
AMEPR40N-Z	90-305	24-42	0.8,0.85,0.9,1.0	3750		-30 to +50		CE
AMEPR40NC-Z	90-264	24-42	0.8,0.85,0.9,1.0	3750	3-in-1 dimming	-30 to +50		CE
50 Watt								
AMEPR50N-Z	90-264	30-42	1.0,1.05,1.15	3750		-40 to +50		CE
60 Watt								
AMEOR60C-AZ	90-305	5-12, 12-24, 24-36, 36-50	1.2, 1.66, 2.5, 5	3000	3-in-1 dimming	-40 to +80		CE
AMEPR60N-Z	90-264	24-42	1.4	3750		-40 to +50		CE

FEATURES

Aimtec's indoor AC/DC LED Drivers come with features such as Accurate Constant Current ±5%, Active Power Factor Correction and output current calibration potentiometers for selected models. Our models also have high efficiency up to 88%, multiple safety features such as Continuous Over voltage, short circuit protection and have been designed to comply to EN55015, EN61000, EN61547 standards for optimal performance.

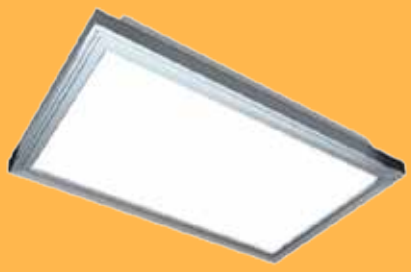
APPLICATIONS

LED Tubing

8" Downlight

Indoor Floodlighting

Spotlights



Ceiling Pannel Lamp

AR111

APPLICATION NOTES

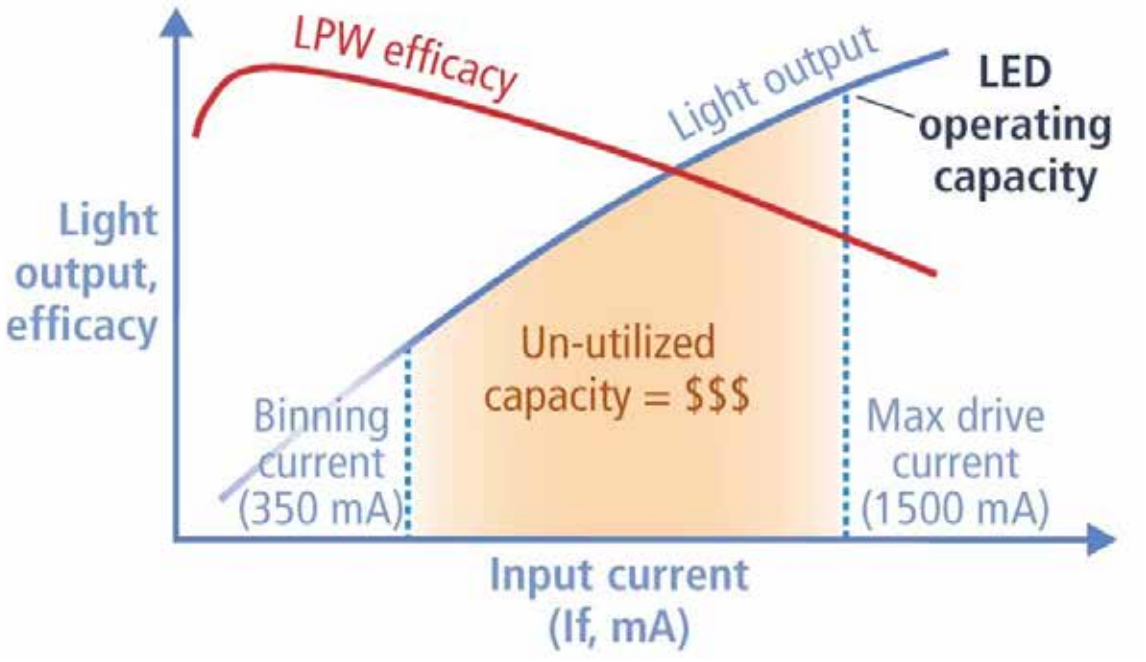
LED DRIVER OUTPUT CALIBRATION

Due to the nature of non-linear LED performance, Solid State Lighting (SSL) design engineers always need to select between a variety of LED packages and electrical and luminous performances to optimize the lighting system. This can range from maximal performance to maximal cost effectiveness.

Since LEDs are a current driven device, its efficacy (lm/W) peeks when the forward current is at its lowest and gradually decreases when the forward current increases.

An SSL fixture's output luminous flux can be considered as the integral sum of individual LEDs' luminous flux. If a specific lumen target is fixed, fixtures can be designed with more partly driven LEDs to meet a high efficacy requirement at a higher cost and alternatively, designed with less fully driven LEDs to meet a cost target by sacrificing efficacy. However, between these two extremes, there lies a sweet spot called the crossover point shown in figure 1.

Figure 1 – LED input current vs. Light Output, Efficacy



Due to the complexity and unlimited choice when comes to designing an LED fixture, SSL design engineers usually cannot select the perfect constant current LED driver and must come to a compromise with what is available.

To allow more freedom to SSL designers, Aimtec provides an optional output current adjustment solution (50%-100% output current adjustment) for LED drivers to meet the required potential design specification.

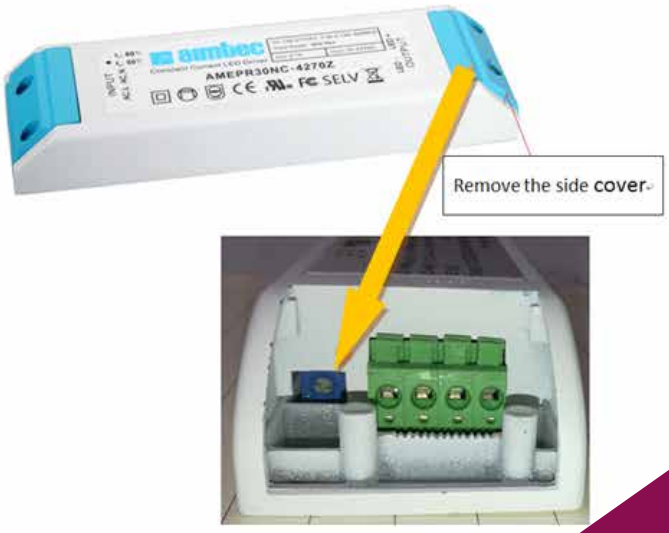
Some of Aimtec's indoor and outdoor LED drivers have optional output current calibration potentiometers. The potentiometer's location is shown in figure 2 & 3. Here are the models that currently include this feature:

AMEPR40NC-42100Z-PD	**AMEPR40N-42100Z-P**
AMER90C-70120Z-PD	**AMER90C-70120Z-P**
AMER120C-70170Z-PD	**AMER120C-70170Z-P**

To adjust the output current, the LED driver should be connected to an actual LED load and the current meter must be connected in series. Once the driver is powered up, the output current can be decreased by rotating the potentiometer counter-clockwise and clockwise for an increase. Once the desired current has been adjusted, glue should be added to hold the potentiometer in place permanently.

Figure 2 – Outdoor LED Driver Calibration

Figure 3 – Indoor LED Driver Calibration



IP RATING

To better understand how Aimtec products fair against adverse weather conditions, it is key to understand how the IP rating system works.

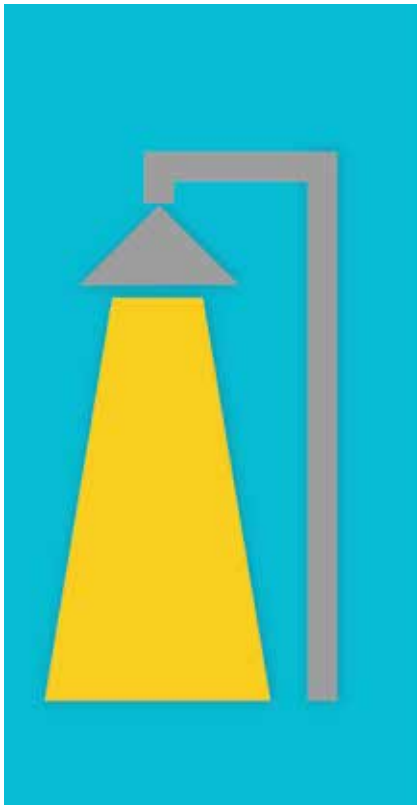
The IP (International Protection Code or Ingress Protection) rating system is a worldwide recognized standard for rating enclosures' immunity to dust (solids) and water (moisture) penetration.

The rating is denoted by the following nomenclature:

IP-xy: where "x" and "y" are each substituted by single digits, denoting a degree of protection from foreign body and water respectively.

Following is the numerical legend that indicates the degree of protection:

First Digit (x)	Description of Degree of Protection from Contact or Foreign Body
0	No Special Protection, Generally not used for pressure or temperature instruments.
1	Protection against solid objects > 50mm in diameter. Generally not used for pressure or temperature instruments.
2	Protection against solid objects > 12.5mm in diameter. Generally not used for pressure or temperature instruments.
3	Protection against solid objects > 2.5mm in diameter
4	Protected against solid objects > 1.0mm in diameter
5	Dust Protected (Ingress of dust not completely prevented)
6	Dust-Tight(No ingress of dust, complete protection against contact)



Second Digit (x)	Description of Degree of Water Protection
0	No Special Protection, Generally not used for pressure or temperature instruments.
1	Protected against dripping water
2	Protected against dripping water when case is tilted up to 15°
3	Protected against spraying water
4	Protected against splashing water
5	Protected against a water jet
6	Protected against heavy jet spray
7	Protected against limited submersion in water(up to 1m of submersion)
8	Protected against continuous submersion in water (up to 2 m of submersion)

Aimtec's entire line of second generation AC/DC LED drivers are in IP68 rated enclosures. They are designed for LED based applications and are suitable for either outdoor or indoor use. With the dust-tight feature and capability to withstand continuous submersion in water, AIMTEC's LED drivers operation under harsh conditions. OTE: IP-68 is equivalent to NEMA 6P rating (US National Electrical Manufacturers Association).

LED LIGHTING

1. Are traditional industrial-grade power supplies suited for LED applications?

Most typical industrial-grade power supplies are not suited for outdoor LED applications for several reasons:

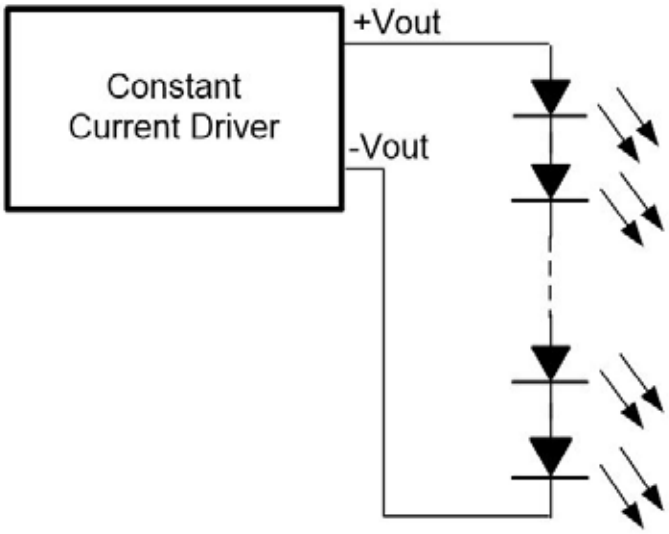
- **The majority of general purpose power supplies provide constant voltage output, while LEDs prefer to operate with constant current drivers. The exception is for some LED blocks or lamps, which require constant voltage either 12 or 24VDC.**
- **Most industrial power supplies are designed to operate up to 40°C ambient temperature without power derating, while LED drivers are frequently required to operate up to 55°C ambient without derating for many indoor and outdoor applications.**
- **The majority of industrial power supplies do not have waterproof and lightning protection features which are required for most outdoor LED lamps.**

2. Which are the most common configurations for connecting multiple LEDs?

- Most LED lighting applications utilize large numbers of high-brightness LEDs.
- LEDs can be connected in several different configurations.
- The three most common configurations are:

Series

The most common configuration is connecting LEDs in series.

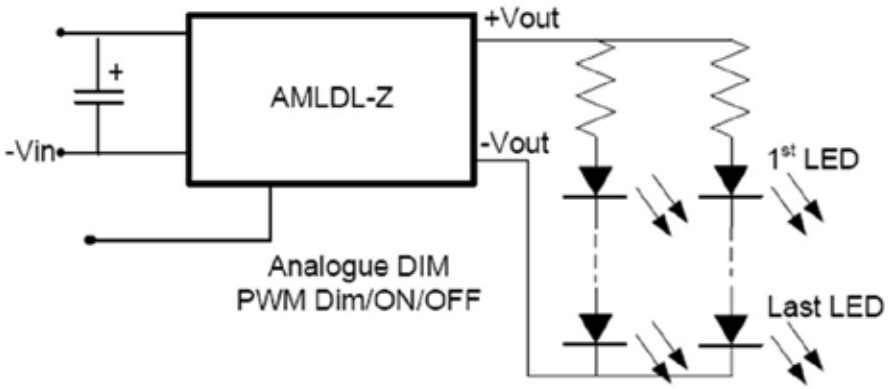


With this configuration a single constant current driver illuminates the entire string of LEDs.

If any LED in the string fails short there will a minimum impact to the system. If any LED fails open the entire string will stop operating, therefore it would be better to use in this configuration LEDs with an internal bypass feature.

Advantages: Low cost and Simple design

Parallel Strings

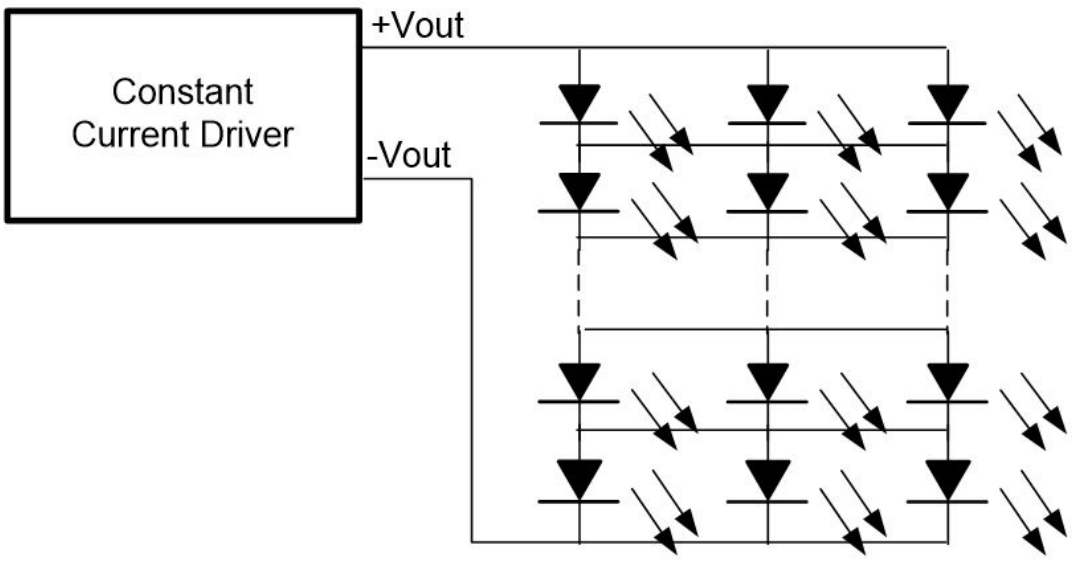


If any LED fails open all LEDs in that string will stop operating, while the other strings will continue operating. If any LED fails short, that string will carry higher current that the other strings increasing the stress levels of the remaining LEDs.

Advantages: Low cost and Simple design

Disadvantages: Brightness of LED is uneven and Poor efficiency

Matrix



A matrix configuration is similar to a parallel configuration but extra connections are used to help minimize the effects of individual LED failures. Multiple LEDs are connected in parallel and then stacked is series. The total voltage and current would remain unchanged from the parallel configuration. If any LED fails short would cause the row of LED to stop operating while the remaining LEDs would be unaffected. Current sharing is a directly related to the matching of the LEDs.

3. What are the advantages to using high efficiency LED drivers?

The main reason for converting from conventional lighting to solid state (LED) lighting is the higher efficiency associated with LEDs. Higher efficiency directly translates to energy savings. Today there are many initiatives aggressively driving reductions in energy consumption and related costs. It is logical to used LED drivers with high efficiency. A driver with 90% efficiency driving an LED with a MTBF of 40000 hours, will save over 500 Kilowatt hours of power consumption during the LEDs lifetime, compared to a driver with only 80% efficiency.

The higher efficiency driver will generate much less unwanted heat, extending its MTBF. A driver with 90% efficiency will generate less than half the heat of a driver with 80% efficiency. The lower efficiency increases component temperatures decreasing their expected lifetimes. For example, electrolytic capacitors lifetimes will decrease by 50% for every 10°C increase in temperature.

Higher efficiency drivers will have 3 to 4 times longer expected lifetimes with higher reliability.

4. What are the advantages to using long-life LED drivers? How are they different?

The main advantages to using LED lighting solutions are higher efficiency and lower maintenance costs. LEDs have longer lifetime expectancy than other lighting solutions giving them a distinct advantage with respect to lower maintenance costs.

However, if in a LED lighting system the drivers' MTBF doesn't equal that of he LED the maintenance cost becomes comparable to that of a conventional light solution negating the justification for the conversion.

The expected lifetime of an LED driver is determined by the number of components and the expected lifetime of each component. The components that mostly influence the lifetime of the driver are the electrolytic capacitors. Only long-life high quality electrolytic capacitors should be used. The lifetime of an electrolytic capacitor decreases by half with every 10°C increase in temperature. When designing a LED driver it is important to design in efficiency to reduce the dissipated heat, as well as thermal convection to minimize the component heating.

5. What is Power Factor (PF) and Power Factor Correction (PFC) and how are they relevant to specifying LED drivers?

Power Factor is a unitless ratio of real power to apparent power in an AC powered system. PF is expressed as a number between 0 and 1. A PF of 1 is the ideal case.

Real power is the actual power used by the driver. The apparent power is the power delivered to the driver from AC source. As the apparent power is the product of the load current and load voltage and because the voltage and current may be out of phase, this product may be significantly greater than the real power. Meaning more power is delivered to the driver than is used by the driver.

Power Factor Correction (PFC) refers to a method that increases (corrects) the PF to a number as close to 1 as possible.

Currently there are many certification standards that require PFC in LED drivers.

A driver with a low PF will draw more power from a utility that a driver with a high PF. This higher input power results in higher utility costs for the same output power.

Power Factor Correction is a very important feature of any AC/DC LED driver system.

6. What are the advantages of using LED drivers with potting? Is potting necessary?

There are two advantages to potting. The first is it provides ingress protection (IP) from dust and water. Potting protects the internal components from coming in contact with water under many conditions, which is critical in outdoor lighting applications.

The second advantage is that potting has better thermal conductivity than air, and as such potting helps conduct heat from internal components to the surface of the driver case. The thermal conduction helps to significantly reduce the thermal stress on the components by as much as 40°C, increasing the components lifetime and the lifetime and reliability of the driver.

7. How are waterproof levels specified for LED drivers?

The water protection level is known as “Ingress Protection” abbreviated as IP.

The IP rating specifies the level of immunity to dust or solid material, and water (liquids) penetration of the driver case. The IP rating typically has two numbers. The first number indicates the protection from dust or solid material ranging fro 0 to 6. The second number indicates the protection level from liquid penetration ranging from 0 to 8. The conditions for water protection the numbers represent as in the previous application note.

CONSTANT CURRENT OR CONSTANT VOLTAGE MODE OF AC/DC LED DRIVERS

Aimtec’s AC/DC LED driver series AMEPR30-AZ, AMEPR60-AZ, AMER90-AZ, AMER120-AZ, and AMER150-AZ all can be utilized in either a Constant Current or a Constant Voltage mode.

The graph shown in Figure 1 details the operating conditions for Aimtec’s 60W AMEPR60-24250AZ.

The drivers are equipped with a current limiting circuit set to the maximum rated current for the specific driver model. As a result, when a load is installed at the output of the driver that would normally result in a high current above the maximum, the current limit circuit forces the driver to operate in constant current mode.

For example, when a LED load is installed the driver will operate in Constant Current mode. The output voltage will be the total forward voltage of the LED load.

With a load resistance (it would be better to use this term because the load can be complex and pulsing) that results in current below the driver’s maximum it will operate in Constant Voltage mode with the load voltage being the maximum rated voltage for the driver model. The load current will depend on the load resistance and will follow Ohm’s law,

Iload = Vmax/Rload.

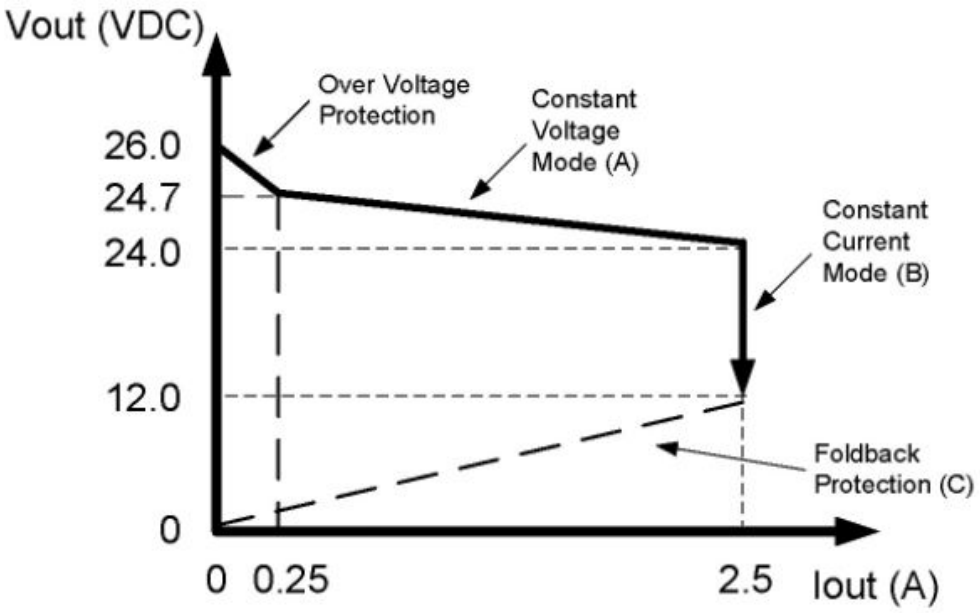


Figure 1

EXAMPLE

Using Aimtec's 60W AMEPR60-24250AZ as an example: it has a maximum rated current of 2.5A with a voltage range from 12 to 24VDC.

Constant Voltage Area (A)

The constant voltage area (horizontal line) begins from zero loading (no load current). Overvoltage protection (OVP) engages at this point and the output voltage is limited to 26.0VDC. When there is a small load current, for example 50mA, the output voltage decreases to 24.7VDC. With increased loading (decreased load resistance) the output voltage will decrease gradually. When the output current reaches the driver's maximum of 2.5A, the output voltage will be 24VDC (Rload=24V/2.5A=9.6 Ohm). This is the point where the driver switches mode into constant current mode (B). With loading from no loading to 9.6 Ohm the driver operates as a conventional AC/DC converter.

Constant Current Area (B)

The constant current area (vertical line) is the area where the output current is stable (fixed), however, the output voltage will decrease with increased loading (decreasing load resistance). For example, with Rload=9 Ohm, the output voltage will be 2.5A x 9 Ohm=22.5VDC, with Rload=6 Ohm, the output voltage will be 2.5A x 6 Ohm=15VDC.

The output voltage will continue to decrease with increased loading (decreased load resistance) until it reaches 12VDC (Rload=12V/2.5A=4.8 Ohm). This is the switching point for the operating mode to fold back protection.

Foldback Operation (C)

Foldback protection mode (dotted sloping line). If the output current increases above the driver's maximum rated current of 2.5A the driver's Over Current Protection (OCP) will engage and the voltage and current will decrease rapidly. The driver will switch into this mode when the load resistance is less than 4.8 Ohm. As the current increases the voltage will decrease to limit the output power of the driver to a safe value.

CONNECTING CONSTANT VOLTAGE LED DRIVERS IN PARALLEL

Aimtec's LED drivers are offered in a wide range of Output Power and Output Voltages. This gives the opportunity to use them in a "stand-alone" configuration or connected in parallel.

Why connect in parallel:

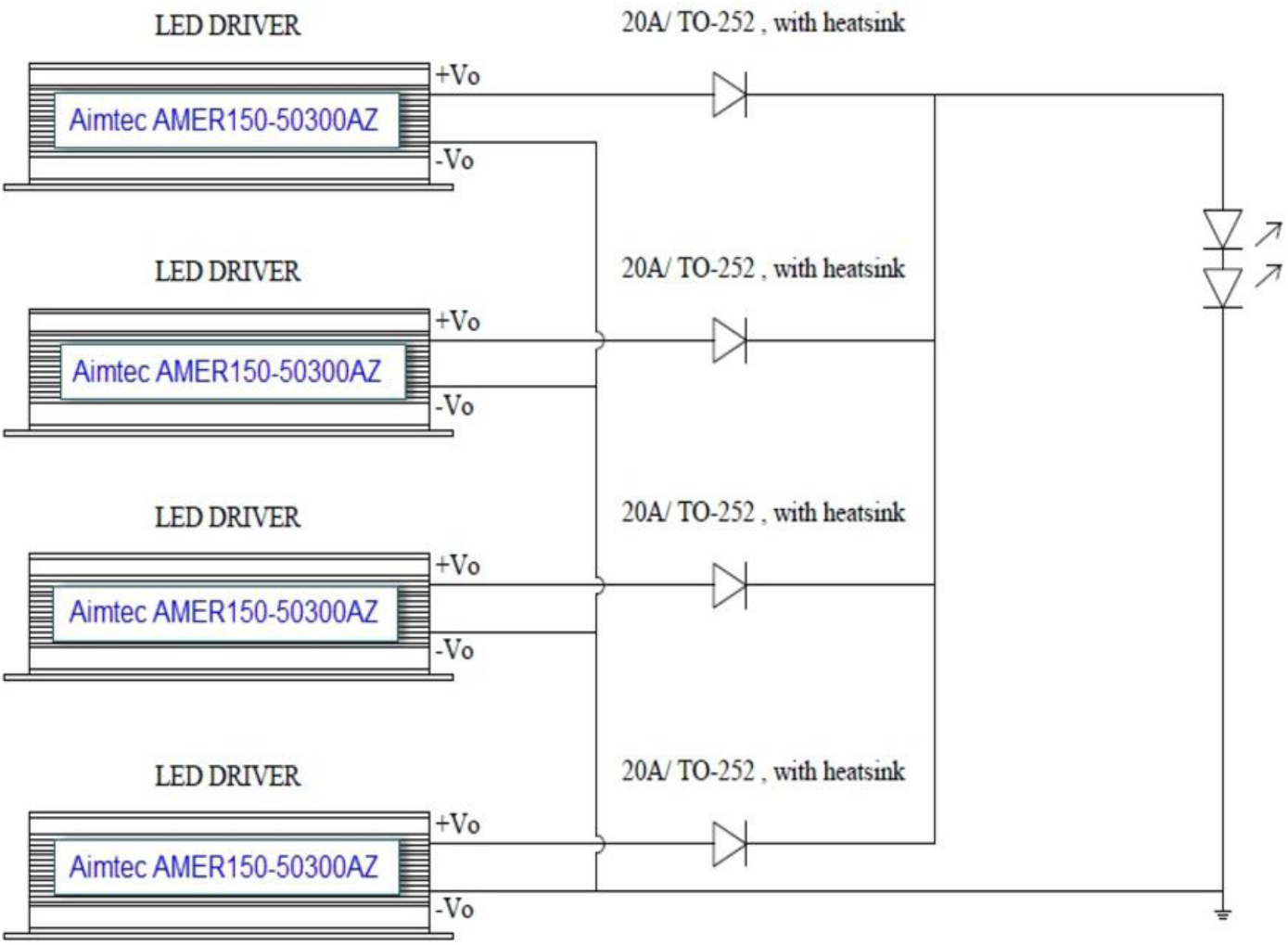
Some of the applications for connecting Constant Voltage LED Drivers in parallel include:

- To increase the Output Power by connecting 2 or more converters in parallel.
- To provide redundancy and to ensure that the system remains functional should a single LED driver fail.
- Higher power requirements can be achieved by using lower power LED drivers in parallel.

How to connect in parallel:

Ideally, the modules should be connected in parallel as shown in Figure 1. In the parallel configuration illustrated, the total output power is shared by the drivers.

Figure 1: 4 AMER150-50300AZ LED Drivers in Parallel configuration, with 20A Diode for circuit protection. Example shown, 50V Constant Voltage LED Drivers in Parallel produce 12A Current, total power 600W.



Important considerations:

- All LED drivers must be in constant voltage mode
- All LED drivers must be of the same model, mixed models will created imbalanced results and are not supported
- Diode selection should be at least 3 times the current of the driver output, with heat sink applied
- As in Constant Voltage mode normally, Dimming function is not supported, customers should order units with the “-F” suffix, without dimming.

CONNECTING CONSTANT VOLTAGE LED DRIVERS IN PARALLEL

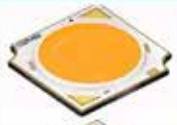
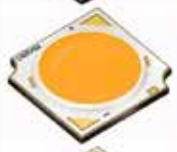
Aimtec's family of Triac LED drivers (AMEPR10D-AZ, AMEPR15D-AZ and AMEPR30D-AZ) are compatible with numerous manufactures of Triac

Dimmers and function with both leading & trailing edge type dimmers. For the benefit of its clients, this application note outlines the test results from Aimtec's evaluations of its LED drivers with a selection of Triac dimmers.

OSRAM COMPATIBILITY

AMEPR30NC-4270Z

AMER60N-42120Z

OSRAM COB Image	OSRAM Model	Forward Current (mA)	Forward Voltage (V)	Power (W)	Aimtec LED Driver	
	GW KAFGB3.CM	460	34.7	16	AMEPR30-4250Z AMEPR30N-4250Z AMEPR30NC-4250Z	
	GW KAFHB3.CM	690	34.7	24	AMEPR30-4270Z AMEPR30N-4270Z AMEPR30NC-4270Z	
	GW KAFJB3.CM	920	34.7	32	AMEPR40-42100Z AMEPR40N-42100Z AMEPR40N-42100Z-P AMEPR40NC-42100Z AMEPR40NC-42100Z-P	
	GW KAGHB1.EM	720	32	23	AMEPR30-4270Z AMEPR30N-4270Z AMEPR30NC-4270Z	
	GW KAGHB2.EM	700	35	25	AMEPR30-4270Z AMEPR30N-4270Z AMEPR30NC-4270Z	
	GW KAGJB2.EM	1200	35	42	AMEPR50N-42115Z AMER50-42120Z AMER50N-42120Z	
	GW KAGLB2.EM	1400	35	49	AMER60-42140Z AMER60N-42140Z	
	GW KAGHB2.CM	700	35	25	AMEPR30-4270Z AMEPR30N-4270Z AMEPR30NC-4270Z	
	GW KAGGB3.CM	460	34.7	16	AMEPR30-4250Z AMEPR30N-4250Z AMEPR30NC-4250Z	

OSRAM COB Image	OSRAM Model	Forward Current (mA)	Forward Voltage (V)	Power (W)	Aimtec LED Driver	
	GW KAGJB3.CM	1150	34.7	40	AMEPR50N-42115Z AMER50-42120Z AMER50N-42120Z	
	GW KAGLB3.CM	1380	34.7	48	AMER60-42140Z AMER60N-42140Z	
	GW KAGMB3.CM	1610	34.7	56	AMER60-42160Z AMER60N-42160Z	
	GW KAHNB1.EM	1400	43.2	61	AMER70N-50170Z	
	GW KAHLB1.EM	1000	46.5	56.5	AMEQR50N-50100Z	
	GW KAHLB2.CM	1920	34.8	67	AMER90-42200Z	
	GWKAHLB2.DM	1920	36.5	70	AMER90-42200Z	
	GW KAHQB2.EM	2530	36	91	AMER120-42250Z AMER130-55240Z	
	GW KAGHB3.CM	690	34.7	24	AMEPR30-4270Z AMEPR30N-4270Z AMEPR30NC-4270Z