



# Xeramix 1 LED Modules Performance Overview





## Introduction

LED technology has rapidly advanced over the last decade with improved criteria of quality & quantity of light, efficacy, life and cost. The XERAMIX™ philosophy is targeting performance well within nominal specification to create luminaires in a class of their own.

Linear LED lighting commonly uses low to mid power LEDs that are run near their maximum power this makes them susceptible to small variances of electrical and thermal tolerance, multiplied over time in real life. Typically economy is a priority over quality of light over time

The Xeramix™ principle is to run LEDs at fraction of their maximum ratings, with the primary criteria of light quality stability and performance over time

In this document you'll learn more about LED performance and why Xeramix™ LED modules are at the forefront of linear LED lighting performance.



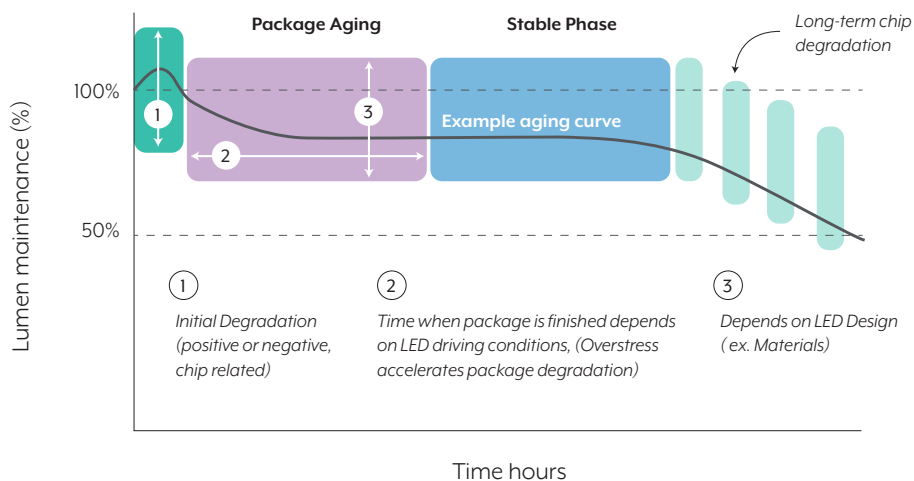
# The life of a LED

A LED goes through several different phases of ageing during its life. Different environmental conditions influence how it progresses through each phase and ultimately affects the lifetime result. For example, at high current and high temperature, the LED could easily burn through 'Package aging' and 'Stable phases' in a shorter time period. In comparison at lower currents and temperature, the LED may spend a long time in the 'Initial degradation phase' which would produce far worse TM-21 results at 6K hours of testing at 10K.

Every LED is unique so there is variation between samples. Some may decrease & stabilise quickly whereas others may be much slower despite residing in the same testing chamber, with the same conditions. Over longer time spans most samples will eventually converge with minimal performance difference.

It is important to understand there are many factors to consider when projecting the life of LED.

## During the lifetime of LEDs we can derive the different phases of aging



The Illuminating Engineering Society has developed several publications relating to the measuring and projection of LED performance and life. For further information please refer to the following documents

### IES LM-80

Measuring Luminous Flux and Colour Maintenance of LED Packages, Arrays and Modules,

### IES TM-21

Projecting Long Term Lumen Maintenance of LED Light Sources

### IES TM-30

Evaluating Light Source Colour Rendition



# XERO LED modules

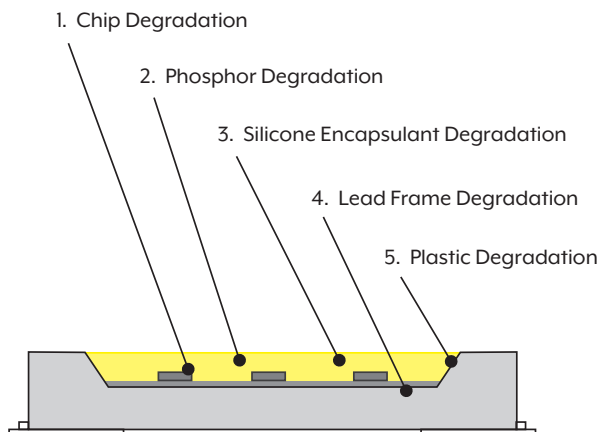
Xero Lighting luminaires have the option of standard Samsung Zhaga LEDs or the extreme performance of Xeramix modules. Although they both use high quality Samsung LEDs there is a significant performance difference between the two options. This is due to simple design philosophy that Xeramix uses high power LEDs running at low power and far more robust LED packages.

## Zhaga LED modules

Mid power Samsung plastic LEDs

Maximum LED drive current 180mA

Typical LED drive current <math><175\text{mA}</math> in Xero luminaire  
LEDs are wired in banks of series / parallel.



### 1. Chip Degradation

Uses different substrates which typically have lower operating technologies.

### 2. Phosphor Degradation

All phosphors will degrade over time.

### 3. Silicon encapsulate degradation

All encapsulate will degrade over time.

### 4. Leadframe degradation

Silver plated leadframe that sits on the plastic package is frail against sulphur attacks. Once exposed to sulphur the silver plating corrodes and loses reflectivity, this effects both the lumen output and CCT.

### 5. Plastic degradation

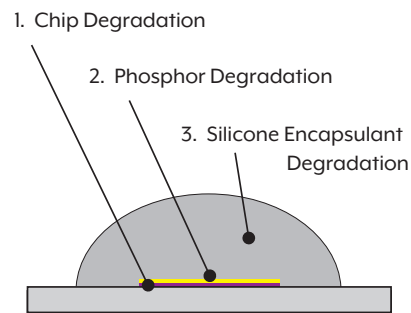
White reflective material is a synthetic plastic resins, operating temperatures and high energy (low wavelength) photons can affect these plastics.

## Xeramix 1 LED modules

High power Samsung ceramic LEDs

Maximum LED drive current 1500mA

Typical LED drive current <math><350\text{mA}</math> in Xero luminaire.  
All LEDs are wired in series for better accuracy.



### 1. Chip Degradation

High powered LEDs achieve excellent LM80 results of L90 typically at much higher temperatures.

### 2. Phosphor Degradation

All phosphors will degrade over time.

### 3. Silicon encapsulate degradation

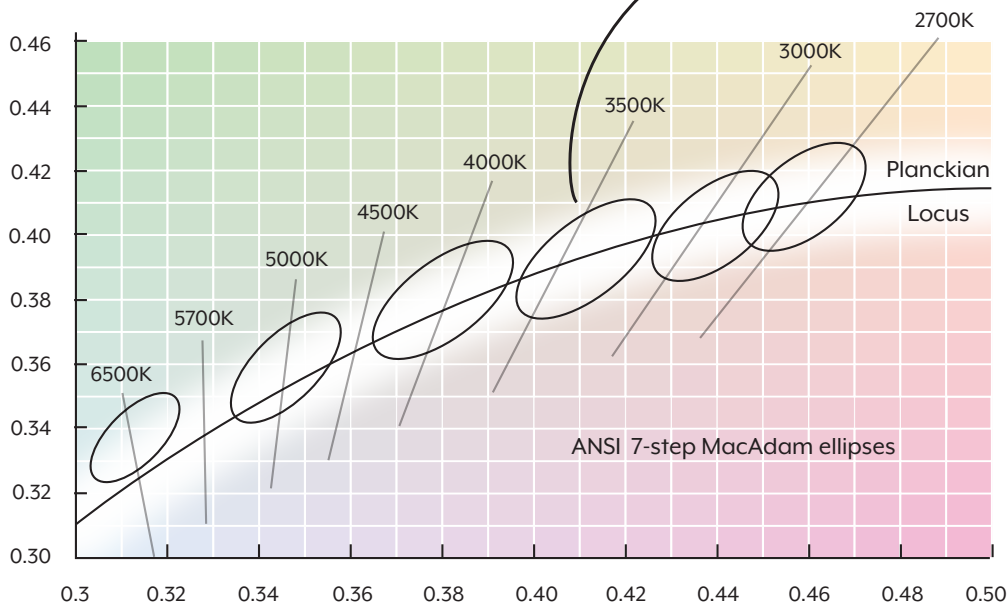
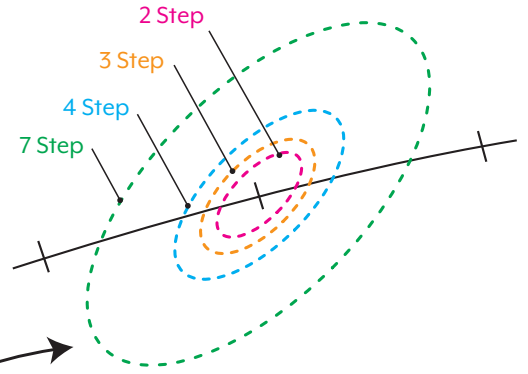
All encapsulate will degrade over time.



# Colour stability

In the study of colour vision, a MacAdam ellipse is a region on a chromaticity diagram which contains all colours that are indistinguishable, to the average human eye, from the colour at the centre of the ellipse.

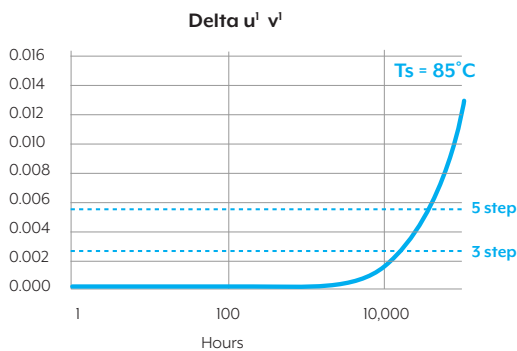
The contour of the ellipse therefore represents the just noticeable differences of chromaticity. Typically professional lighting systems have now standardised on 3 step or lower.



It is important to consider that over time LEDs 'colour shift' in addition to Lumen maintenance.

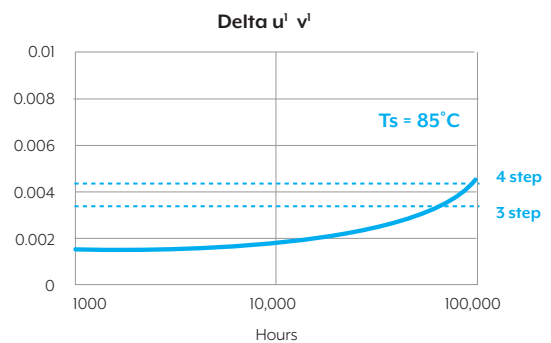
## Zhaga LED modules

Mid power Samsung plastic LEDs  
 Typical LED drive current <math><175\text{mA}</math> in Xero luminaire.



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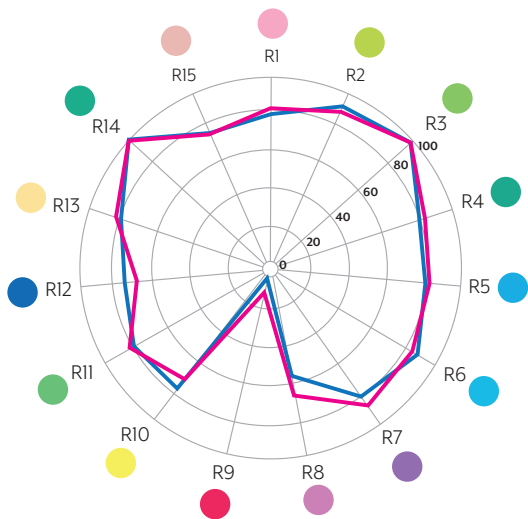
# Colour Quality

It is important for an LED light to reveal object colours faithfully to ideal or natural light sources. Traditionally a min CRI value was considered however the actual ability to render colour swatches is more commonly considered, in particular the R9 value of an LED. In recent times the Fidelity and Gamut of LED are now also considered and explained in TM30-15.

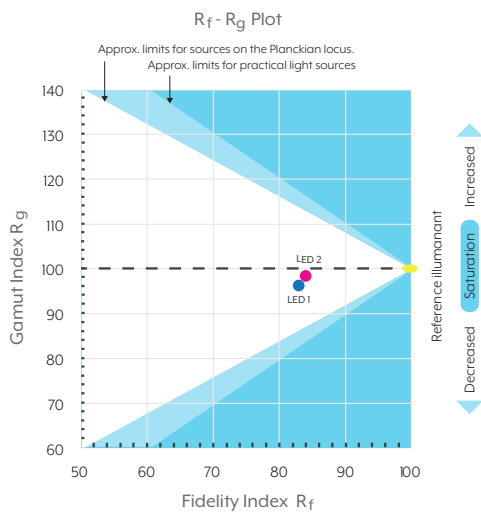
## Zhaga LED modules

Mid power Samsung plastic LEDs

Typical LED drive current <175mA in Xero luminaire.



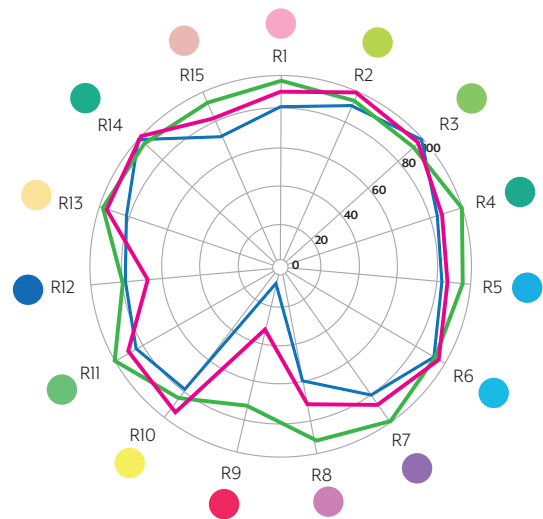
LED 1 — 2580 - 3230K (CRI 80)  
LED 2 — 3230 - 4280K (CRI 80)



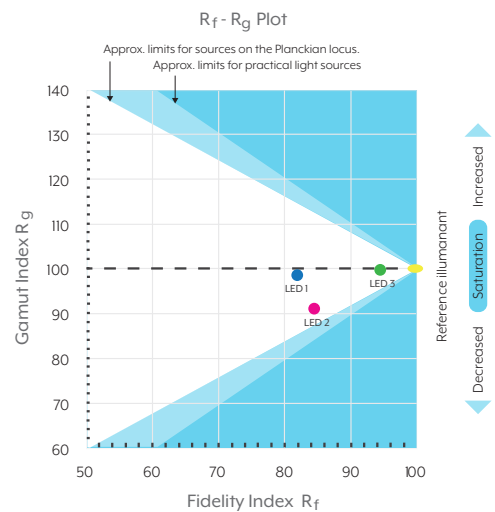
## Xeramix 1 LED modules

High power Samsung ceramic LEDs

Typical LED drive current <350mA in Xero luminaire.



LED 1 — 2580 - 3230K (CRI 80)  
LED 2 — 3230 - 4280K (CRI 80)  
LED 3 — 2580 - 3230K (CRI 90)



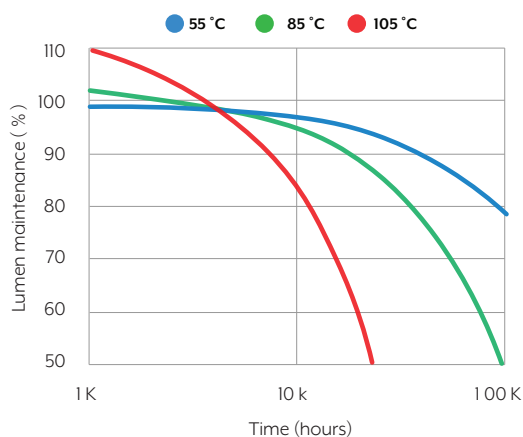
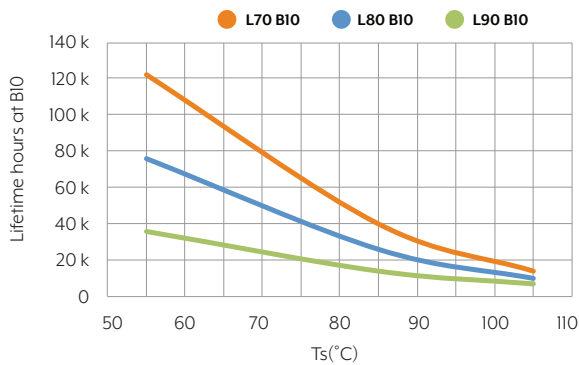
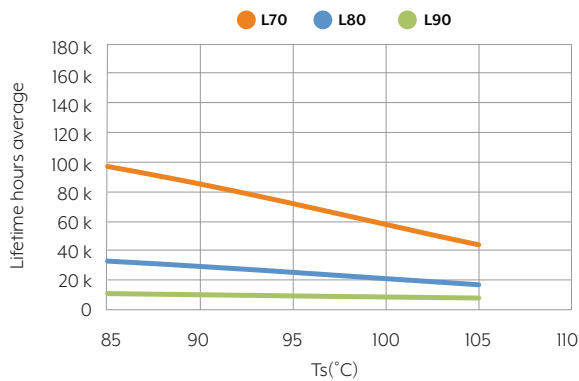
# LED Lifetime

The lifetime of a LED module inside a luminaire is related to the luminous flux depreciation at a given temperature this is expressed as Lxx and Bxx. For example the L80 value indicates how many lumens in % that remains after end-of-life. The B50 value indicates that the declared L-value will be achieved by minimum 50% of the LED modules and that the remaining 50% may have a lower lumen value. The value B10 means that minimum 90 % of the LED modules will meet the declared L-value and only 10% will have a lower flux level.

## Zhaga LED modules

Mid power Samsung plastic LEDs

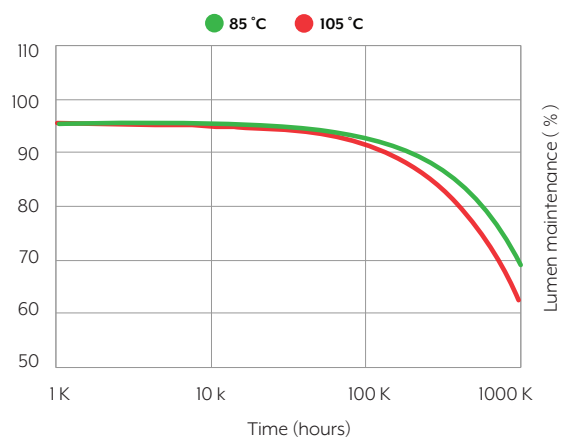
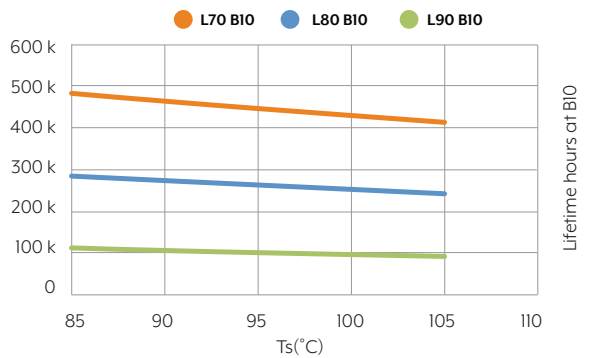
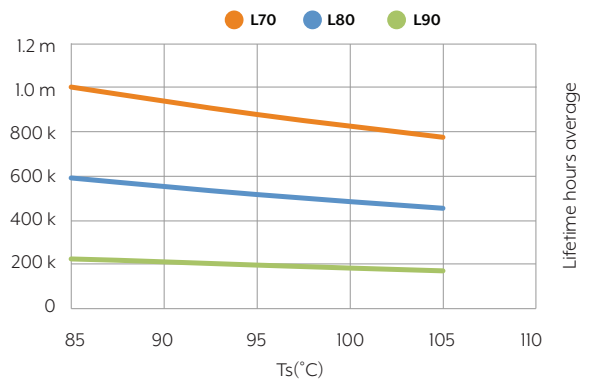
Typical LED drive current <175mA in Xero luminaire.



## Xeramix 1 LED modules

High power Samsung ceramic LEDs

Typical LED drive current <350mA in Xero luminaire.



# The perfect balance

In conclusion the Xeramix I boards have been engineered to find the right balance of the four important characteristics of LED modules for the professional lighting industry. The end result is Xero luminaires have exceptional performance in several criteria with a value proposition that is still economically viable for every lighting project.



# Unsurpassed performance

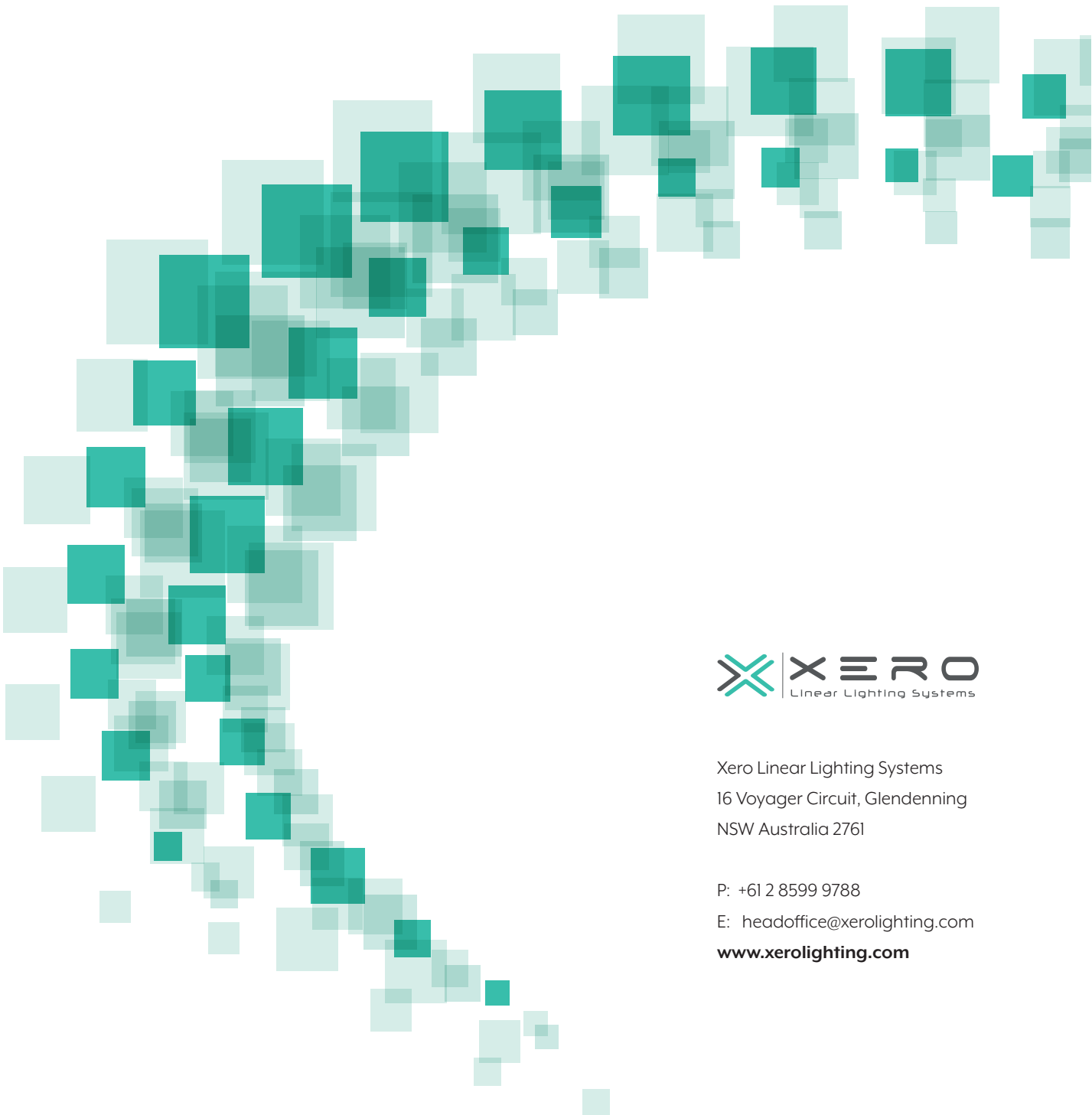
**Xero's luminaires unsurpassed performance of L90 B10 @ 114K hours ECONOMIC LIFE is achieved by using high performance LEDs at a fraction of their capability. This lifetime projection is still typical even in the most demanding environments where daily temperatures can average up to 35°C and even peak to 50°C ambient temperature. Unlike other LED modules that are typically operated near maximum ratings, Xeramix modules have liberal operating headroom to ensure performance isn't jeopardised by minor effects of the unknown.**

# Contact us

For any additional questions or information relating to the information provided you can contact the technical team at :

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