



香港電器工程商會 HONG KONG ELECTRICAL CONTRACTORS' ASSOCIATION

會員通訊

四月 - 六月

NEWSLETTER

APR - JUN 2013



地址：香港灣仔譚臣道 114 號廣亞大樓 8 字樓

電話 TEL : 852 2572 0843

網址 WEBSITE : <http://www.hkeca.org>

ADDRESS : 8/F., Kwong Ah Building, 114 Thomson Road, Wanchai, Hong Kong.

傳真 FAX : 852 2838 2532

電郵 EMAIL : Adm@hkeca.org

T5 節能光管的超低損耗「電感」鎮流器 Ultra-low-loss magnetic ballasts for T5 lamps

香港大學電機電子工程系許樹源教授

Professor Ron Hui, Department of Electrical & Electronic Engineering, HKU

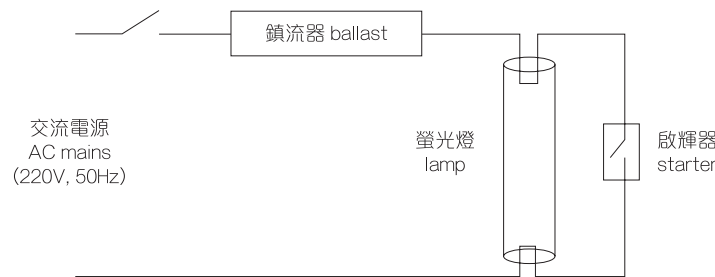


背景介紹

螢光燈（俗稱「光管」）的發明，自 1940 年代開始一直是全球照明系統採用的主要光源。螢光燈是一種放射燈，其電流需要受到控制，以保持功率的穩定。照明技術一般採用「鎮流器」（俗稱「火牛」）來控制光管的電流和功率。（圖一）

Background

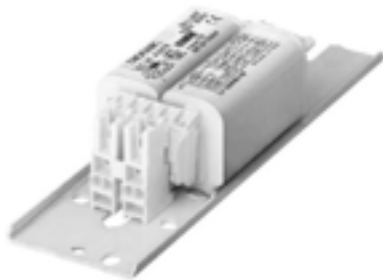
Since their invention in mid 1940's, fluorescent lamps have been used as a major light source in society. Fluorescent lamps are discharge lamps that need a device called "ballast" to limit their current and thus their power. (Fig. 1)



(圖一, Fig. 1)

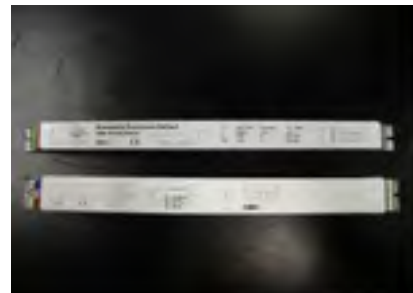
鎮流器可分類為「電感式」和「電子式」。自 1940 年代中，「電感」鎮流器是螢光燈具的主要配件。「電感」鎮流器的結構極之簡單，主要是以一個磁鐵芯和一組銅綫圈組成，一般的壽命超過二十年，磁鐵芯和銅綫圈也可以循環再用。（圖二）

Nowadays, ballasts can be classified as "magnetic" and "electronic" types. Magnetic ballasts have been used since 1940's. Their structures are very simple. Each unit consists of a magnetic core and a copper winding. Its typical lifetime exceeds 20 years. The core and the winding can be recycled. (Fig. 2)



(圖二, Fig. 2)

自 1980 年起，「電子」鎮流器的興起，日漸形成一鼓新興勢力，漸漸取代「電感」鎮流器作為控制光管的主要手段。「電子」鎮流器是一種電路，一般由數十個電子元件組成，以高頻推動螢光燈。（圖三）



(圖三, Fig. 3)

相對「電感」鎮流器，「電子」鎮流器的好處包括提高效率 and 減少螢光燈的閃爍現象。以「電子」鎮流器取代「電感」鎮流器可以節省 17% 的用電量，因此採用「電子」鎮流器成了照明業界過往二十年的趨勢。當業界在 2000 年代中期推出光功率最高新一代的 T5 節能光管的時候，照明業界甚至說明只有「電子」鎮流器才適用於 T5 光管，同時在最高功效的國際鎮流器標籤計劃當中 (A-Class)，並沒有包括「電感」鎮流器在內。

Since early 1980, electronic ballasts have emerged as a more energy efficient solution to replace magnetic ballasts. Electronic ballasts are electronic circuits, each comprising thirty or more electronic components. They operate the fluorescent lamps at a high frequency. (Fig. 3)

Compared with traditional magnetic ballasts, electronic ballasts have the advantages of a high energy efficiency and the elimination of flickering effects in the lamps. In the last 20 years, it has been thought that replacing magnetic ballasts with electronic ones can save about 17% electric power for traditional fluorescent lamps. When the T5 lamps were promoted as a new generation of high energy-efficiency lamps in mid 2000s, the lighting industry recommended electronic ballasts only for T5 lamps. Magnetic ballasts were not even included in the Class-A classification of the energy efficiency rating of ballasts.

隨著「電子」鎮流器的興起，其涉及的電子廢料問題日見嚴重。根據市場調查的資料顯示，全球在 2005 年之一年內共生產了超過二億件「電子」鎮流器。因為「電子」鎮流器內須要一種只有三到五年壽命的「電解電容」，「電子」鎮流器也不可循環再用，由「電子」鎮流器引發的電子廢料問題，可想而知。

However, the electronic waste issue increases with the increasing popularity of electronic ballasts. According to market survey, over 200 million units of electronic ballasts were made in 2005. Limited by the



總括而言，「電感」鎮流器的優點包括 (1) 壽命長和 (2) 可循環再用。缺點是 (a) 耗電量較「電子」鎮流器為高。「電子」鎮流器的優點是 (1) 節能，缺點卻是 (a) 壽命短和 (b) 不可循環再用。

創新的「可持續照明技術」- 超低損耗「電感」鎮流器

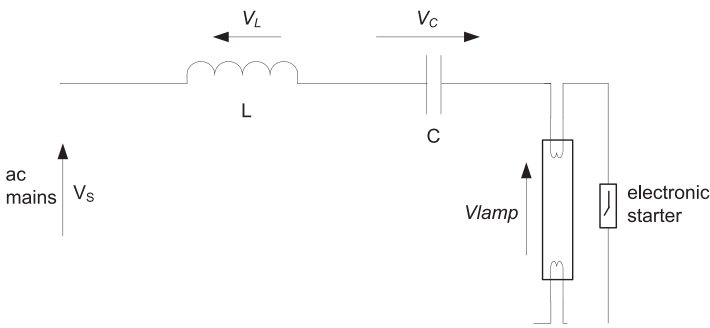
香港大學電機電子工程研究團隊提倡新一代「可持續照明技術」的概念，這概念與傳統「能源標籤計劃」(只包括能源效益一項) 不同。可持續照明技術包括三個要素：

- (1) 高能源效益
- (2) 長產品壽命 (多於十年或以上)
- (3) 可循環再用

基於這種可持續發展的概念，許樹源教授領導的研究團隊發明一種符合以上三種條件的超低損耗「電感」鎮流器。

超低損耗「電感」鎮流器適用於新一代的 T5 節能光管，包含三種元件 (圖四)：

- 電感 L - 由鐵芯及銅線組成，壽命超過 20 年，並可循環再用。
- 電容 C - 非電解電容，一般壽命超過 10 年。
- 啟輝器 Starter - 電子元件少於「電子」鎮流器的 10%，只於啟動光管一秒之內運作，一般壽命超過 10 年。



(圖四, Fig. 4)

新技術已被國際獨立專家評審，並已發表在國際電機電子工程師學會 (IEEE) 的電力電子專業期刊上。其中技術表現和環保表現的比較，分別列於表一和表二。

lifetime of a component called "electrolytic capacitor", electronic ballasts have typical lifetime of 3 to 5 years. Electronic ballasts cannot be recycled and therefore their disposal could lead to serious environmental problems.

In summary, traditional magnetic ballasts have the advantages of (1) long lifetime and (2) recyclability, and the disadvantage of (a) a lower energy efficiency than electronic counterparts. Electronic ballasts have the advantage of (1) energy saving, and disadvantages of (a) short lifetime and (b) not recyclable.

Novel Sustainable Lighting Technology – Ultra-low-loss Magnetic Ballasts

The researchers at the Department of Electrical & Electronic Engineering, HKU promote a new concept of "Sustainable Lighting". Different from the Energy Labeling Scheme which includes only energy efficiency, the new concept covers 3 important factors:

- (1) High energy efficiency
- (2) Long product lifetime (>10 years)
- (3) Recyclability (>80% materials recyclable)

Based on these factors, the HKU research team led by Professor Ron Hui has successfully developed the "Ultra-low-loss magnetic ballasts" to meet the 3 criteria for sustainability.

The Ultra-low-loss magnetic ballasts are suitable for T5 fluorescent lamps. It consists of 3 components (Fig.4):

- Inductor L - A magnetic core and a copper winding (lifetime exceeding 20 years; recyclable)
- Capacitor C - Non-electrolytic type (typical lifetime exceeding 10 years)
- Starter - amount of electronic components less than 10% of electronic ballasts (only used in the ignition time – less than 1 second; expected lifetime 10 years).

The new invention has been peer-reviewed by independent professionals and its results have been published in the IEEE Transactions on Power Electronics in 2011. Comparative summaries of their technical performance and sustainability are listed in Table 1 and Table 2, respectively.

表一, Table 1

Model T5-28W lamp	輸入功率 Input Power (W)	光管功率 Lamp Power (W)	鎮流器損耗 Ballast Loss (W)	光通量 Luminous Flux (Lumen)	能源效益 Energy Efficiency (%)	系統光效 System Luminous Efficacy (Lumen/Watt)
超低損耗電感鎮流器 Ultra-low-loss Magnetic ballast	31.2	28.7	2.5	2423	92.0	77.66
電子鎮流器 Electronic Ballast	31.6	26.9	4.76	2411	85.1	76.30

表二, Table 2

可持續要素 Sustainability Criteria	電子鎮流器 Electronic ballasts	超低損耗電感鎮流器 Ultra-low-loss magnetic ballasts
節能 Energy Saving	✓	✓
壽命 Lifetime	✗ (3-5 years)	✓ (>10 years)
可循環再用 Recyclability	✗	✓ (80%)

新技術有下列的長處：

- 改變以往 20 年照明業界大量採用電子鎮流器的主流，從而大量減少電子廢料。
- 因為新產品的預計壽命超過 10 年，物業管理機構可以大量減少維修保養的人手和費用，並因為要維修而引致的商業損失和不便。
- 新產品適合溫差大的環境，適合大型停車場、走廊、樓梯及公共場所的照明系統。
- 用後的產品物料可以回收，鐵芯和銅線可以作廢金屬變賣，不單環保，還可收回部份成本。
- 新發明已被工業界採用及產品化。新產品已通過國際認可實驗室認證程序，獲發 IEC 證書，其能源表現被評為 A 級，與最佳的電子鎮流器同等。

註一：

以上一代常用的 T8-36W 光管為例子，如果以同一光度作為標準，採用「電子」鎮流器的總系統功率大約是 36W，而採用傳統「電感」鎮流器的總系統功率卻是 42W。所以照明業界自八十年代開始以電子鎮流器取代電感鎮流器。



T5 光管是新一代的節能燈，也是全球光效最高的光源之一，其「系統光效」超過 70 流明 / 瓦，與現有優良的 LED 產品相約。T5 光管是高電壓、低電流的光源，T8 光管是低電壓、高電流的光源。T5 與 T8 光管明顯不同之處是其等效電流很低（表三），而「電感」鎮流器的「銅線損耗」是與電流的平方成正比，其「磁鐵芯損耗」與電流成正比。從表三可見，以「電感」鎮流器推動 T5 光管，其銅線損耗及磁鐵芯損耗分別減少 84% 及 60%。

Advantages of the new invention

- It has the potential of changing the current pattern of using electronic ballasts in public lighting, and consequently may drastically reduce electronic wastes arising from lighting industry.
- Because the expected product lifetime exceeds 10 years, it is envisaged that property management companies can save lots of efforts and costs in maintenance, and also the economic losses arising from the closure of shops and venues for such maintenance.
- The product design can cope with wide temperature range. They are particularly suitable for general public lighting applications such as car parks, corridors, stair, hallways and general public areas.
- Over 80% of the product materials can be recycled. The iron core and copper winding can be sold as waste metals. This is not only environmentally friendly, but also cost saving.
- The invention has been adopted by lighting industry and commercialized. The new products have passed IEC test requirements by certified laboratory. Its energy efficiency rating has been classified as "A-Class", same as the best electronic ballasts in the market.

Note 1:

Taking the traditional T8-36W lamp as an example and using the same light output as reference, the total system power consumption of an electronic ballast system is 36W, whilst that of a magnetic ballast system is 42W. This is why lighting industry has been replacing magnetic ballasts with electronic ones in the two decades.

T5 fluorescent lamps are a new generation of high energy-efficiency lamps. Its luminous efficacy is amongst the highest. Its system luminous efficacy exceeds 70 lumens per Watt and is comparable with that of high-quality LED products. T5 lamps are high-voltage and low-current lamps, while T8 lamps are low-voltage and high-current lamps. Their major difference is that T5 lamps have much lower current rating (Table 3). It is important to note that the copper conduction loss is proportional to the square of the current, and the magnetic core loss is roughly proportional to the current. From Table 3, it can be seen that, when applied to T5 lamps, the magnetic ballast will have its conduction loss reduced by 84% and core loss by 60%.

表三, Table 3

光管種類 Lamp Type	傳統光管 T8 36W	節能光管 T5 28W
光管電壓 (伏特) Rated voltage (Vrms)	103	167
光管電流 (安培) Rated current (Arms)	0.44	0.175
銅線損耗 Conduction loss (i^2R)	100%	16% (減少 84%)
鐵芯損耗 Core loss	100%	40% (減少 60%)



商會活動 HKECA Activities



癸巳年春節團拜 2013 Year of Snake Chinese New Year Gathering

蛇年春節團拜於 2013 年 2 月 27 日 (年初十八) 於本會會址舉行。在會址會員互相恭賀生意興隆後便前往銅鑼灣百樂門酒家晚宴。席間除有春節應節菜色外還有一味特別菜色 - 豬腳薑醋，那是商會理事之一吳嘉汶小姐當日下午特別送來給予各位分享她二月份弄瓦之喜。

Celebrating the year of Snake, on February 27, members first met at Association venue to greet each other for a prosperous year; then moved to Paramount Restaurant for Spring dinner. Besides the regular new year dishes, one of our EC members Ms Aries Ng offered the traditional Vinegar Pig's Knuckle with Ginger to announce the news - birth of her baby girl in February.



香港機電業 (技術人員) - 就業及發展 E&M Trade Career Promotion Exhibition

商會及其他 17 個單位參加 3 月 1-2 日於葵涌職業訓練局葵涌大樓 2 樓禮堂由機電工程署牽頭舉行之「香港機電業 (技術人員) - 就業及發展」推廣日，目的是鼓勵青年人加入機電行業。是次活動反應熱烈，一連兩日展覽會共有 2700 多位中學生及 VTC 學員入場參觀。讓市民大眾更加了解機電業的光明前途及投身途徑。

E&M Trade Career Promotion Exhibition (led by EMSD and joined by 17 other companies / trade associations) was held on March 1-2, 2013 at VTC building at Kwai Fong. Over 2700 visitors, mostly high school and diploma students, had visited the exhibition. It achieved the target to let the public know more about the E&M trade and the career path for youngsters to join the trade.



『電力安全』研討會 Electrical Safety at Site Seminar

有超過一百人參加本會與香港電燈有限公司在 2 月 26 日再度合辦『電力安全』研討會。

Over 100 members attended the Seminar jointly organized with HKE on Electrical Safety on February 26





搵食資料 Notes to Trade



承建商合作培訓計劃 (Contractor Cooperative Training Scheme) CCTS

為鼓勵青年人加入機電行業，發展局即將推出 - 承建商合作培訓計劃 CCTS。職業訓練局 VTC 2013 年 4 月招收約 595 名學生，目標是完成中三或以上之青年人，2013 年 9 月開課。成功被招收學生分配入 7 個機電工種 Basic Craft Certificate (BCC)，上課期間每位可獲補貼 \$2,800/ 月 x 11 個月。學生除在課室中學習工種基本理論及技術；公司也每一兩個星期提供壹至半日實踐訓練。學生完成壹年 BCC 後 VTC 向香港機電工程商聯會推薦給其會員聘用為見習工人為期 3 年。

2013 年 4 月起在工程超過 \$5,000 萬合約需參與合作培訓計劃 CCTS。承判商需聘用完成 BCC 學生為機電見習工人

- 見習工完成 3 年受訓期保證續聘用至少 12 個月，工資不少過 \$10,000/ 月
- 見習工人受訓期間政府補貼 (由僱主代發)
公司導師 - (\$20,000/ 月 ÷ 4) x 見習工人數
見習工本人 - 六個月 (150 天計) 每日 \$150

職業訓練局 VTC - 更新中專教育文憑 / 學徒訓練計劃

為配合三三四學制職業訓練局 - 更新其中專教育文憑 / 學徒訓練計劃，詳情請瀏覽網址 <http://apple.vtc.edu.hk>

即將舉辦之活動 Upcoming Events



2013 年度亞洲太平洋電氣工事協會聯合會議 FAPECA 2013 Conference Bali Indonesia

第 27 屆亞洲太平洋電氣工事協會聯合會議已定於 2013 年 6 月 5-7 日 (星期三至星期五) 在印尼 - 巴厘島舉行；會議主題：更新能源 Renewable Energy 歡迎各會員參加。查詢請電 25720843

Next FAPECA meeting is schedule to be held at Bali, Indonesia on June 5-7. Conference theme: Renewable Energy. All members are welcome to join. For enquiries please call 25720843

專業才華展示日 2013 Skills Show

商會參加由學徒事務署主辦之專業才華展示日。定於 2013 年 4 月 25 日 (下午二時至五時) 及 4 月 26 日上午 10 時至下午五時在葵涌興盛路 85 號職業訓練局青年學院 (葵芳) 2 樓禮堂舉行。有十多個商會及單位參加即場向中學生展示各行業資訊及專業技術示範。

廣州國際照明展覽會 Guangzhou International Lighting Exhibition

2013 年廣州國際照明展覽會將於 2013 年 6 月 9 日至 12 日在中國進出口商品交易會展館。商會可為會員辦入場証

2013 Guangzhou International Lighting Exhibition will be held at China Import and Export Fair Complex on June 9-12. HKECA can arrange admission card for their members.

Our Association together with other trade Association will join the Skill Show organized by Pro -Act Apprenticeship VTC on 25 April 2pm -5pm and 26 April 10am to 5pm at 2/F Youth College (Kwai Fong) 85 Hing Shing Road, Kwai Chung, New Territories.

會員動態 Member's News



香港電器工程商會 1/2013 - 3/2013 年度新會員名單

入會日期 Join Date	會籍 Membership Status	申請會員名稱 Applicant Name	代表人 Representative
1/2013	普通會員 Ordinary Member	中信工程服務有限公司 Chung Shun Engineering Services Ltd.	余其中先生 Mr. Yu Ki Chung
1/2013	普通會員 Ordinary Member	斯洛民有限公司 Zinoman Limited	茹顯民先生 Mr. Yu Hin Man Warren



今年增輝賀歲盃於三月五日在觀瀾湖高爾夫球會 - 尾崎將司球場珍舉行。在此多謝增輝集團公司的慷慨贊助。當日比賽有 17 組球員出席，高手林立，戰情十分激烈。經一番角逐後，優勝者名單公佈如下及謹此對得獎者祝賀。

Junefair Group Chinese New Year Cup has been held successfully on 5 March 2013 at Mission Hills Golf Club – OZAKI Course. We would like to express our appreciation to Junefair Group for his kind sponsorship. A total of 17 Tee of our members have joining the competition. Prize list are as follows and congratulate to all the winners.



深圳觀瀾湖高爾夫球會 – 尾崎將司球場

Missions Hills Golf Club Dongguan-Oskai Course

冠軍	姚柱良先生
亞軍	冼自強先生
季軍	陳強先生
最低杆	陳強先生
最佳前九	宋子文先生
最佳後九	林樂基先生
最遠發球獎：第 3 洞	梁志剛先生
最遠發球獎：第 14 洞	麥國樑先生
最近洞獎：第 6 洞	林俊傑先生
最近洞獎：第 8 洞	吳積成先生
最近洞獎：第 12 洞	麥國樑先生
最近洞獎：第 17 洞	林俊傑先生
嘉賓組冠軍	蔡育瑜先生

Champion	Mr. lu, Chu Leung
1st Runner Up	Mr. Sin Chi Keung
2nd Runner Up	Mr. Chan Keung
Best Gross	Mr. Chan Keung
Best Front Nine	Mr. Soong Tze Man
Best Back Nine	MR. LAM Lok Lei
Longest Drive Hole No 3	MR. LEUNG Chi Kong
Longest Drive Hole No 14	Mr. Denny Mak
Close to Pin Hole No 6	Mr. Lam C K
Close to Pin Hole No 8	Mr. Gilbert Ng
Close to Pin Hole No 12	Mr. Denny Mak
Close to Pin Hole No 17	Mr. Lam C K
Guest Winner	Mr. Choi York Yee



Connect your panels to any facility management system with a single click

Acti 9's prefabricated, one-click control wiring and Modbus protocol makes communication fast and easy

Monitor, control power on every floor, sector, office, and workshop

The new Acti 9™ communication system is ready-to-connect, and easily integrated with any facility management architecture. It combines basic control with optimum protection to manage energy efficiency solutions in any environment. Using flexible, robust, and easy-to-use Modbus communication protocol, the system provides real-time data from your panels and circuits. It fine-tunes load control and monitoring, and includes prefabricated wiring to give you instant, error-proof connectivity.

A better use of energy, from start to finish

The Acti 9 system also gives you unmatched operational efficiency. Its flexibility reduces project and installation costs, and provides the most reliable, configurable, and extendable modular communication system to your customers. It adapts to any future developments, and becomes a key element in your energy efficiency strategies, now and in the future.

Component selection is easy, design is simplified, and upgrades are painless. And as new standards emerge or building requirements are modified, Acti 9 scales to meet your needs.

Available only from
Schneider Electric™



Discover how capable automation, control, and monitoring of energy usage can deliver up to 30% energy savings

Visit www.SEreply.com Key Code 47817y



Acti 9 communication system

Panel communication has never been so flexible and fast to implement

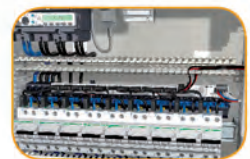
Ready to be connected

Centralize control, collect energy meter data with just a simple communication module.



Save 40% of your time

One-click, prefabricated wiring for communication between your distribution panel and any facility management system.

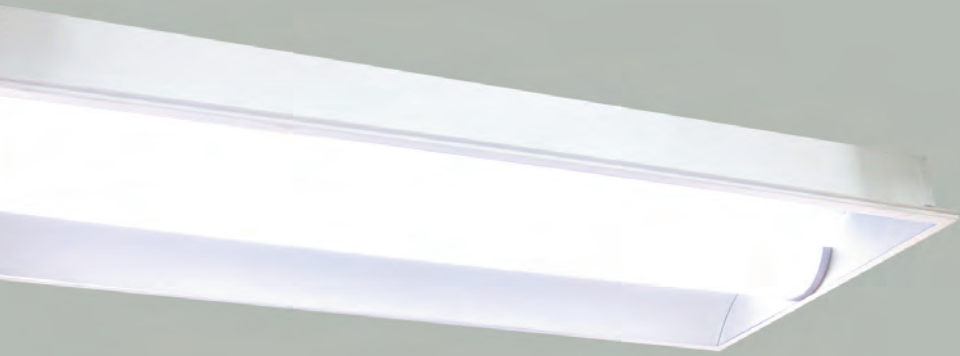


Safe and reliable

Reliable, error-proof manufacturer-guaranteed connections. EMC tested for immunity, radiated, and conducted safety.



Schneider
Electric™
施耐德電氣



Compare to traditional T5 or T8 lighting fitting, 5200 series indirect LED module lighting fitting has:

- outstanding and innovative outlook
- an extra soft and gentle light output
- excellent vertical illumination performance
- minimal glare
- easier re-lamping (hinge down without any tools)
- less dirt accumulation on the louver
- ease the problem of temperature-sensitive
- energy saving less 40% power consumption compare with and 2x28W T5 fluorescent lighting fitting
- better uniformity compare with 2x28W T5 fluorescent lighting fitting (0.39 vs 0.34)

MAXGRAND • *Your Lighting Solutions*
since 1992

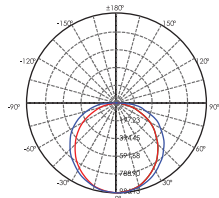
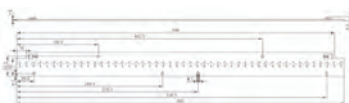
Better Life Better Environment • LED Lighting Solution



Linear LED Module Characteristics:



- simple electrical interconnection of LED modules
- suitable for continuous line configuration of modules without gaps and dark zones
- optionally to dimmable with 1-10V, DALI & Push-Dim interface
- optimised temperature distribution
- high value for colour rendering CRI > 80
- low colour tolerance of 4 SDCM
- high module efficiency of up to 125 lm/ W
- lifespan up to 50,000 hours



Power Consumption	37W
Luminous flux	3150lm
Efficiency	85lm/W
Colour temperature	4000k
Colour Rendering	>80
Oper. current	350mA
Oper. voltage	48V
Dimmable	By 1-10V or DALI or Push-Dim
LOR	73%

