

ADVANCED LIGHTING TECHNOLOGY FOR MAXIMUM EFFICIENCY

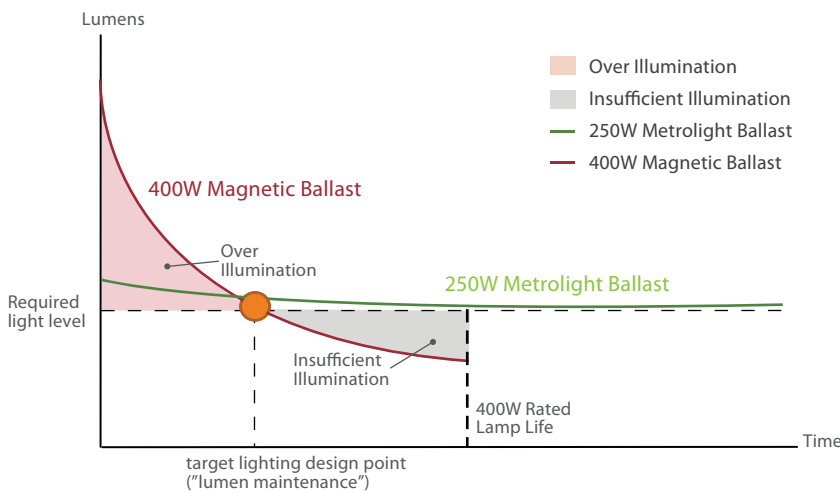
Lighting is a significant energy consumer that can be leveraged immediately to improve business performance through reduction of energy use and maintenance costs. Metrolight's SmartHID™ electronic ballasts for 100 watt through 450 watt lighting systems represent a powerful and energy efficient option for a range of applications that deliver significant advantages including:

- Substantially reducing energy consumption without sacrificing light levels
- Spectacular light - no color variation, flicker and noise free
- Improved lumen maintenance & extended effective lamp life
- Built-in controlled dimming
- Advanced analog and digital control
- Flexibility to drive both eHID and LED technologies
- Fully programmable for increased flexibility

Improved Lumen Maintenance Enabling Use of Lower Wattage Lamps without Sacrificing Light

Conventional Pulse Start HID lighting systems, powered by magnetic ballasts, experience a 40-50% fall-off in light output over the published life of the lamp. Probe Start systems are even worse, typically losing 60-70% of initial light output. As such, lighting designers are forced to radically overdesign initial lumen levels to compensate for this fall-off, wasting substantial amounts of energy. In addition to the rapid light degradation, the magnetic systems' power and light are very input voltage dependent. Combined with the low power factor, significant power transmission losses exist. These systems thus experience color variation, flickering and operational noise.

Enabling Same Maintained Light with Lower Energy Consumption



Achieving the required light without the need to compensate with 'over-design' for rapid lumen degradation

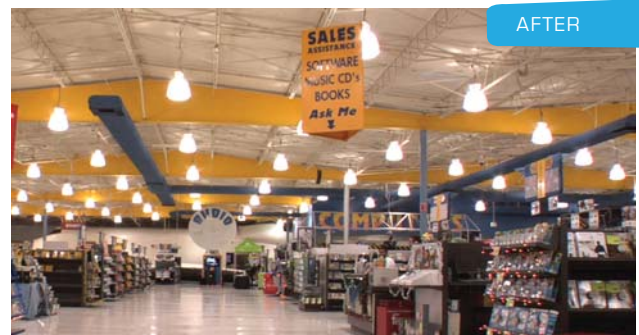
Metrolight's SmartHID™ electronic ballasts offer significant improvements in lumen maintenance and efficiency when compared to conventional HID lighting systems driven by pulse start magnetic ballasts & other technologies. These improvements allow the use of a lower wattage lamps to achieve equal or even slightly higher, maintained light output.



Use 35-55% lower wattage lamps to achieve the same maintained light

CASE STUDY

Fry's Electronics Complete Rollout Project



- Total Energy Savings: 70%
- Annual Savings >\$5M
- ROI: 7 Months (After rebates)
- Lamp Power: Reduced from 400W to 320W, and from 250W to 175W

Metrolight's Energy Savings: Typical Examples

Metrolight Wattage Retrofit	Base Wattage (W)	New Wattage (W)	Wattage Savings (W)	Wattage Savings with Dimming (W)
1000 to 450*	1090	480	610 (56%)	730 (67%)
1000 to 400*	1090	426	664 (61%)	771 (71%)
400 to 320**	460	344	116 (25%)	202 (44%)
400 to 250	460	269	191 (42%)	258 (56%)
320 to 200*	375	217	158 (42%)	212 (57%)
250 to 175	290	190	100 (34%)	148 (51%)

*1000W probe start, results in slightly lower maintained lumens

**Results in higher maintained lumens

How Do We Achieve This?

Pulse start magnetic ballasts introduce a stressful ignition process. The ballasts push excessive ignition current that severely overheats the electrodes. This causes material to be splattered on the internal lamp walls reducing their transparency and causing micro cracks in the arc tube. The result is wall blackening and lumen degradation, which dramatically reduce light output.

Metrolight's patented MicroStart™ microprocessor controlled gentle ignition, provides the exact amount of energy needed to ignite the lamp. This ignition reduces wall blackening, increases maintained lumens, and significantly extends lamp life.

Identical 400W Metal-Halide Lamps After 8,000 Operating Hours

Pulse Start Magnetic Ballast



Tungsten Electrodes Eroded



Significant Arc-Chamber Wall Blackening

Metrolight's SmartHID™ Electronic Ballast



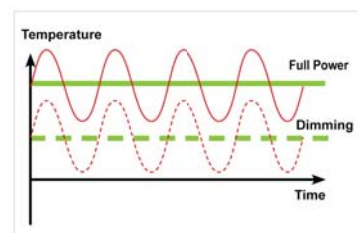
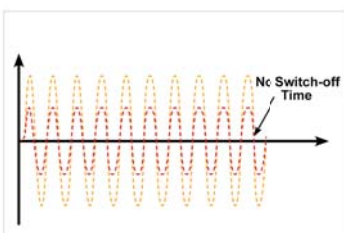
Tungsten Electrodes Intact



Negligible Arc-Chamber Wall Blackening

Optimized High Frequency Operation

Standard magnetic ballasts drive an HID lamp by a low grid frequency (50-60Hz) sine wave. This changes the polarity of the electrodes 50-60 times per second. During the wave transition, the lamp is virtually switched off for a few milliseconds causing the electrodes to cool. The frequent, drastic temperature changes erode the electrodes until they no longer function, and also shorten lamp life and blacken its walls. Metrolight's high frequency mode of operation preserves lamp electrodes from erosion and thus increases the efficacy of the lamps, improves its performance and extends the lamp lifetime.



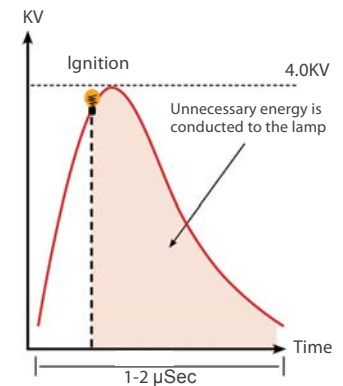
Electrode Temp. at Full Power

Electrode Temp. while Dimming

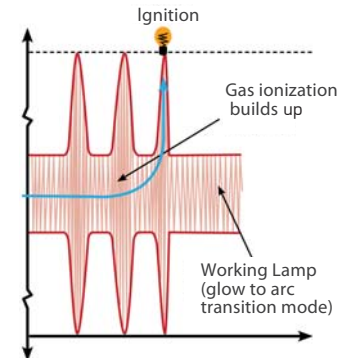
MicroStart™ Technology

- ▶ Minimizes wall blackening
- ▶ Maintains lighting output
- ▶ Extends lamp life

Electro-Magnetic Ballast



Metrolight's Electronic Ballast



Metrolight's patented MicroStart™ electronically controlled ignition and normalized operation maintains lighting performance over time

Metrolight's optimized high frequency mode of operation ensures no switch-off time and ensures electrodes are kept at a stable temperature level

Built-in and Controlled Dimming

Metrolight offers three control mechanisms that enable customers to:

- Further reduce their energy consumption
- Control and monitor each single light point (full digital control)
- Meet codes and standards such as California Title 20/24 & LEED certification

SmartDIM Auto Profile Dimming

The SmartDIM is a built-in automatic dimming capability of the SmartHID™ electronic ballast. The capability is designed for parking lots and other applications that do not require full brightness during off hours. The SmartDIM eliminates the need for any type of costly communication system or additional devices to control the dimming process. Without the need for any sensors, controls, extra wiring or any extra labor, and at no additional cost, SmartDIM provides a simple dimming option that substantially increases energy savings and helps customers meet potential dimming requirements.

SmartDIM calculates the midpoint between the time the lamp is turned on and the time the lamp is turned off, which is typically midnight, and dims the lamp to 50% for 6 hours, starting one hour before the midpoint. Typically, dimming will begin at 11 pm and will end at 5am. The dimming profile times and dimming levels can be modified upon special request to include up to 16 different steps.

0-10V Analog Dimming

Metrolight's SmartHID™ electronic ballasts are compatible with a wide range of control devices such as occupancy sensors, daylight harvesting sensors, timers, dimmers, etc. Furthermore, the dimming response is continuous and not bi-level such as: outdated dual capacitor pulse start magnetic HID dimming systems. In daylight harvesting applications for example, analog devices can be used in specific zones to measure and control the light output in response to sunlight levels. When bright sunlight is present, the system will dim all the way down to 50%; when sunlight levels are reduced the light level will gradually increase in response, and only when daylight is no longer present will the light level go to full 100% thus ensuring that the required light levels are achieved at the right time.

Full Digital Control

Metrolight's electronic ballasts are fully compatible with network-based lighting control systems via a MADLI (Metrolight's Propriety Protocol) interface. Offering wire-line, wireless or PLC connectivity, Metrolight's system enables the remote management and control of each light point in large-scale and multi-site installations. Providing unique energy and cost-saving tools to streamline lighting controls in a variety of applications, our lighting and energy management capabilities provide the ultimate flexibility to meet changing client requirements.

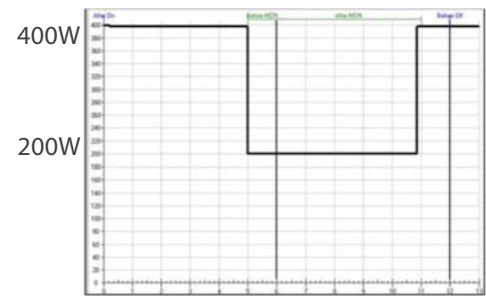
- Real time software monitoring, diagnostics and management
- Advanced schedules and policy-based energy management
- Smart automated dimming and activation
- Control of individual light points over multiple sites
- Wire-line, wireless and PLC connectivity options

Efficiency Summary: Up to 70% Total Energy Savings

In comparison to legacy pulse start magnetic HID solutions, Metrolight's electronic ballasts provides up to 70% energy savings as follows:

- 35-55% through the use of lower wattage lamps without sacrificing lumen levels
- 8-10% due to the internal efficiency of the electronic ballasts
- Up to 40% through the use of built-in or externally controlled dimming

Sample Auto - dimming Profile



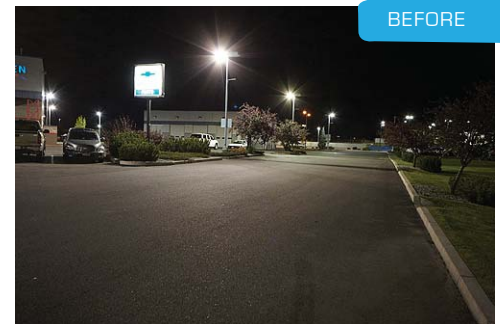
Nominal Fixture Wattage: 400W

Actual Avg. Consumed Wattage: 323W

CASE STUDY

Knudtsen Chevrolet

Implemented SmartDIM combined with using lower wattage lamps



- Total Energy Savings: 65%
- Annual Savings: \$34,946
- ROI: 1.7 Years (After rebates)

35-55%
savings

Lamp Wattage Reduction

Wall blackening prevention

8-10%
savings

Efficiency

Electronic vs. magnetic efficiency

↑ 40%
savings

Control

Controlled dimming adjust light to the exact amount needed

Software Configurable

Metrolight's electronic ballasts offer vast configuration flexibility and can be software reprogrammed to different wattage levels, to support eHID, MH or HPS and LED. In addition, these ballasts can be software programmable to disable the SmartDIM™ function, to set auto-dimming response times and modify many other variables. This flexibility allows OEMs and distributors to stock a single part for multiple applications, significantly reducing inventory and retaining flexibility. Units can also be field re-programmed giving the end user flexibility to meet evolving requirements.

Utility Rebate Eligibility

The demand for electricity continues to rise and government regulations as well as our own increasing awareness of the environmental implications limit the ability of utilities to increase energy supply to meet this demand. As a result, public utilities have established rebate programs to encourage the use of new and proven energy-efficient technologies. Lighting systems are a central component of these programs as significant energy savings can be realized by replacing outdated systems. Metrolight is recognized by major public utilities as a leading provider of energy efficient lighting systems and as such, customers using Metrolight's electronic ballasts are eligible for substantial rebates and incentives.

Below is a partial list of participating utilities:



Additional Benefits

- ▶ Fully Protected against: surges, over - heating, short circuit, temporary over voltage and lamp end of life
- ▶ Constant light output regardless of entire input voltage range
- ▶ Power factor > 0.95
- ▶ Remote mounting
- ▶ Small footprint
- ▶ ISO9001 certified manufacturing

Certifications



ABOUT METROLIGHT

Metrolight provides proven energy-efficient eHID and LED solutions for high-power lighting. Metrolight's ballasts and managed lighting solutions are used in retail, industrial, commercial and municipal installations to reduce energy consumption and carbon emission by 70%. Pioneering lighting energy solutions since 1996, Metrolight operates worldwide with over 750,000 systems deployed and over 8 billion hours in operation. For more information, please visit our website at www.metrolight.com

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