Electronic Ballasts for High Intensity Discharge Lamps (HID)

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Electronic Ballasts for High Intensity Discharge Lamps (HID)

In recent years there has been an increase in the use of electronic ballasts to operate various types of High Intensity Discharge (HID) Lamps– High Pressure Sodium (HPS), Metal Halide (MH) and Mercury Vapor (HM).

As opposed to the magnetic ballast which requires the addition of a capacitor and an ignitor, the electronic ballast is self-sufficient. With the increasing use of these electronic ballasts, it is important to understand both of these technologies, i.e. the magnetic and the electronic.

In order to help clarify our customers' understanding, we have outlined the significant advantages and disadvantages of Eltam's Electronic Ballasts for High Intensity Discharge (HID) Lamps.

Advantages of Electronic Technology

- Improves the overall efficiency of low wattage systems.
- A single unit replaces three components: ballast, capacitor and ignitor.
- Protects against voltage and current transients and lamp malfunction (e.g. DC effect near end-of-life).
- Stable light output.
- Stable watt output despite AC line voltage fluctuations.
- Power factor very close to 1.0.
- Lamp-friendly ignition process.
- Perfect square wave lamp current: increases longevity and improves lumen maintenance.
- Option for lamp monitoring and control.

Disadvantages of Electronic Technology

- The benefit of the efficiency of electronic ballasts decreases with rising lamp watt rating.
- Complex product because of complicated operational tasks.
- Sensitivity to high temperatures affects installation options.
- High cost.
- Acoustic resonance when lamp is operated at high frequency (Eltam's HID electronic ballast operates the lamp at low frequency).

Comparison of Lamp Operation

	Electronic Ballast	Magnetic Ballast
Lighting	Good control of ignition process and excellent control of lamp current following ignition reduce electrode meltback and shorten the glow stage with overall effect of longer lamp life	Limited control of the ignition process and lamp current following ignition
Current	Lamp current is square wave at low frequency that leads to increased lamp longevity	Sinusoidal lamp current with peaks 40% higher than the RMS value
Voltage	Square wave lamp voltage	Trapezoidal lamp voltage
Lamp Watt Output	The watt output is a direct product of the lamp voltage and current (lamp power factor = 1.00) hence lower current is required for a given watt output	Lamp power factor is between 0.80 - 0.92 hence higher current is required for a given watt output
Lamp Current Polarity Inversion	Faster current polarity inversion (minimal intervals at low current values) increases lamp longevity	Relatively long intervals of low lamp current near zero crossing of the current wave
Reignition Voltage	No reignition overvoltage required during steady state operation	Some reignition overvoltage required, creating trapezoidal lamp voltage

Contribution of the Electronic Ballast to Lamp Longevity and Lumen Maintenance

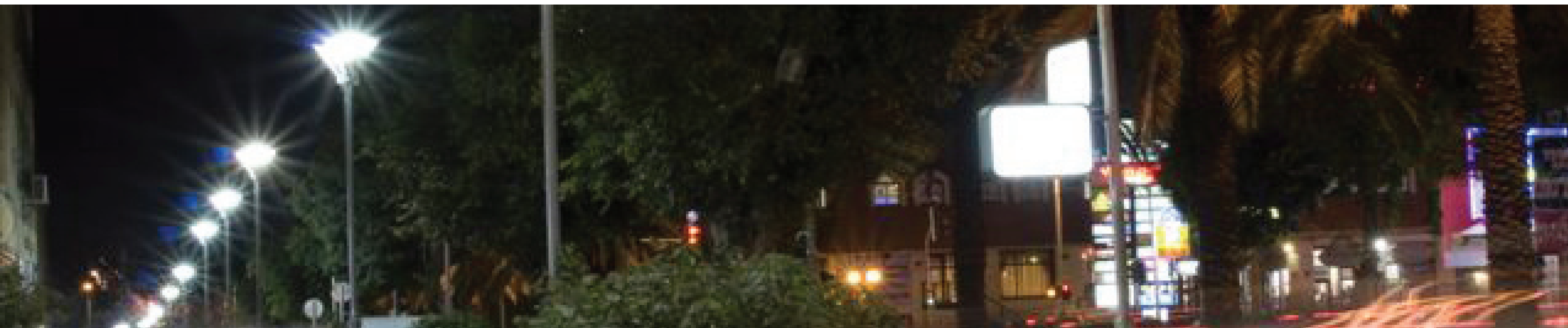
- Lowers electrode meltback and shortens the glow stage through good control of the ignition process.
- Lamp current is square wave at low frequency.
- Faster lamp polarity inversions (minimal intervals at low current values).
- No reignition overvoltage required during steady state operation.

Criteria for Examination and Selection of Electronic Ballasts for High Intensity Discharge Lamps (HID)

Lamp Operation Frequency

- Because of the acoustic resonance effect in HID lamps operated at high frequency, manufacturer approval is required for each specific lamp type.
- Operation of the HID lamp at low frequency square wave does not require specific lamp manufacturer approval.
- Performance Standard Proposals for HID electronic ballasts relate only to lamp operation at low frequency square wave. Official standards are now in advanced stages of preparation.

  Note: When operating the lamp at low frequency square wave, make certain that the high frequency harmonics content is extremely small.



Operation Environment

- Actual working temperature is lower than ballast rated maximum.
- Electromagnetic compatibility standards (Surge, EMI, Harmonics content) are met.
- Input current is undistorted.
- Ballast inrush current and its effect upon the line overcurrent protection.
- Automatic ballast shut off upon line or lamp malfunction.

Potential Of Eltam's Electronic Ballast Control

	Advantages	Disadvantages
DALI	▪ Appendix to the ballast standard: EN 60929 ▪ Low voltage, polarity - independent control input ▪ Addressing options: entire system, group-wise or individual ▪ Scene memory ▪ Feedback in the event of defective lamp ▪ No group wiring required ▪ Every DALI ballast can be individually addressed ▪ No need for scene memory modules ▪ Synchronized scene transitions ▪ Feedback regarding ballast and lamp condition ▪ Simple integration with facility management system	▪ Wiring required ▪ Only 64 ballasts can be controlled by the same controller ▪ Operating software required ▪ Limited operating distance. ▪ Not ideal for outdoor applications
PWM	▪ Simple power control ▪ Accurate power control ▪ Rigid communication	▪ Wiring required ▪ No communication feedback from ballast
PRESET	▪ No special wiring ▪ Special preset lamp power in advance ▪ Hassle free	▪ No controlling opportunities ▪ No compensation of lumen depreciation ▪ New calibration of lamp power must be done individually and manually
Pre- Programming	▪ Pre-programmed dimming scenes ▪ Optimization of lighting ▪ Dimming scene according to "Astronomic Clock" ▪ No special power supply required to serve the scene module	▪ No controlling opportunities ▪ No compensation of lumen depreciation ▪ New calibration of lamp power must be done individually and manually

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