Eigenlite™ Linear Programmable Light Source Technology

SUMMARY

'Eigenlite' digital light sources combine light emitting diodes with linear programmable drive circuitry and active optical feedback. The 'Eigenlite' architecture offers many advantages over conventional light sources and light source drive systems. 'Eigenlite' sources are precisely controllable and programmable in intensity and spectral content, as well as exhibiting excellent linearity and long term stability.

OVERALL SOURCE DESIGN

Electrical

Eigenlite sources use light emitting diodes driven by digitally controlled constant current circuits. Their use of precision voltage references, along with active optical feedback, enable a stable output in conjunction with dial-operated 'ultra-linear' brightness adjustment. In addition to linear digital brightness control, the incorporation of multiple independent spectral channels provides spectral and colorimetric programmability of the output.

Eigenlite light emitting diodes exhibit the expected cool operation, require minimal venting, and allow reliable operation of the source over a range of ambient temperatures. Overall power consumption is low enough for operation with a battery pack. NIST-traceable calibration of the spectral output, brightness, and uniformity, add to the reliability of the source as an optical reference tool.

Optical and Mechanical

Eigenlite sources utilize cylindrical, mechanically rigid, industrial style optical projection heads, which are easily coupled to other optical assemblies such as integrating spheres, projection optics, filters or other components.

Eigenlite sources are designed to maximize optical output whether the source is used alone or in conjunction with other components.

LINEAR BRIGHTNESS CONTROL

Eigenlite sources are built around a 16 bit DAC-controlled linear brightness adjustment circuit, which can be operated at comparatively high speeds, and exhibits excellent repeatability.

An integral real-time optical feedback circuit arbitrates the brightness control circuit, resulting in the *Eigenlite's* 'ultra-linear' intensity adjustment capability… i.e. the source can be linearly adjusted without independent monitoring by a radiometer, without the need of neutral density filters or other attenuators, ad without the need for pulse width intensity control. The brightness can be controlled manually with a dial, or through RS-232 serial computer commands.

For added functionality, pulse width control is still available, offering an additional dimension of intensity and temporal adjustment beyond regulated 'continuous wave' operation.

LONG TERM STABILITY

The *Eigenlite's* fully integrated real-time optical feedback system monitors the source output and constantly adjusts the brightness to maintain the selected brightness setting. Long-term brightness instability is approximately 1% between factory calibrations (e.g. annual). Short-term brightness instability is much less than 1%.

The Eigenlite's low power LED drive and logic circuitry exhibits far less optical power drift on a watt for watt basis than virtually any thermal source.

RELIABILITY AND THERMAL CHARACTERISTICS

Eigenlite sources use comparatively cool-operating low power LED's, resulting in reliable operation for many years. They do not exhibit the thermal stress-related failures associated with the high current drive circuits found in tungsten, halide, other thermal

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sources…and also found in high power LED sources. The useful operating life of *Eigenlite* standard package LED lamps is typically in the range of 5000-20,000 hours, as compared to 1000-3000 hours for both thermal sources as well as the high power LED's found in many other LED source products.

Eigenlite sources can be operated reliably even in high temperature environments (up to 40 degrees Celsius), while retaining their linearity of adjustment, as well as their long term stability.

AMBIENT LIGHT COMPENSATION

At the heart of the real-time optical feedback circuit is the *Eigenlite's* photodiode preamp system. This includes an 'ambient light compensation' function which can sample ambient light and adjust the *Eigenlite's* output according to ambient light conditions.

SPECTRAL AND COLORIMETRIC OUTPUT

The *Eigenlite* RS-5B spectrally programmable source allows the creation of both narrowband and/or broadband spectrums with arbitrary spectral distributions, as well as providing 'push button' standard illuminants and individual color components. Each *Eigenlite* RS-5B spectral channel is individually calibrated and can be individually controlled. For colorimetric applications, the *Eigenlite* RS-5B can be used to accurately reproduce color coordinates over a much larger gamut than most any standard RGB source, while exhibiting a much smaller color error than is possible with three component RGB sources or reflective color test targets.

SPECTRAL OPTIMIZATION

The *Eigenlite* RS-5B photodiode preamp system also functions as a 10 channel spectrometer which can be used to sample light over its 10 channel range of center wavelengths. This sampling can be used to adjust the *Eigenlite's* spectral output to accommodate the specific distribution of a given scene, or, alternately, to compensate for the spectral characteristics of an optical instrument or other spectrally 'nonuniform' attachment used with the RS-5B.

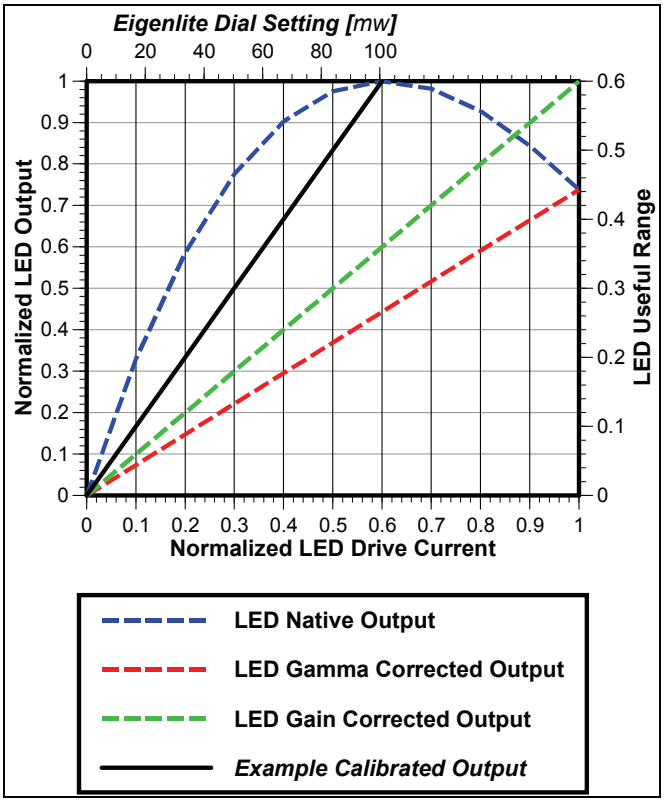

FIGURE 1

NIST-TRACEABLE COMPLETELY DIGITAL LIGHT SOURCE

The *Eigenlite* high resolution digital LED drive, active optical feedback, and 'push-button' control, results in a solid state source wherein the native transfer function of the LED's has been digitally corrected and adjusted for both gamma and gain, and is calibrated in absolute NIST-traceable units. See Figure 1 above. *Eigenlite* sources are truly *completely digital light sources*.

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