TECHNICAL REFERENCE 2010
Electro-Luminescent Signs

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1. ELECTROLUMINESCENT TECHNOLOGY

There exist two basic types of lamps: incandescent and luminescent. With incandescent, an electrical current passes through a conductor (filament) creating a certain resistance and thus creates both light and heat. The more resistance and heat that is created the greater the intensity of light. With luminescent you have the contrary, and as the name implies, light is generated via radiant energy without creating temperature.

There are various types of luminescent lamps: electroluminescent, fotoluminescent, fluorescent and others. In the case of electroluminescent, light is produced as the result of a determined substance being exposed to an electrical current.

The scientific discovery of electroluminescent (EL) technology occurred in the first decade of the 20th century, however was only made commercially viable in the early 1990´s. One of the most well known electroluminescent products on the market today is the Light Emitting Diode (LED).

In the late 1990´s, scientific studies were performed using powder made of encapsulated phosphorous particles. By locating this powder substance between two layers of electrodes and then applying a small electrical current the first luminous film was created. This discovery later led to the creation of a completely viable and commercially available luminous film.

Today electroluminescent (EL) technology is being applied in many market sectors around the globe and will eventually substitute many of today's existing products as well as facilitate the creation of many new products. Many market sectors are rapidly adopting EL technology as a principle resource in illumination, one of the biggest sectors being publicity.

2. TECHNICAL CHARACTERISTICS

Architecture
Although today many steps in constructing EL displays are automated, a great many other steps in the process are done manually, thus the entire process is considered artesanal and takes a considerable amount of time.

The final product is a combination of various layers of distinct and diverse materials with different functions working together, which include:

- **Encapsulation:** a thick protective layer which protects against humidity and other elements. This layer is flexible and serves as a supportive element supporting the entire structure. This layer is generally made of PVC or other similar material.
- **Rear Conductor:** This layer conducts electrical current and is formed by a metallic membrane composed of cathodes typically made of Barium, Titanium or Silver. This layer is responsible for stimulating the phosphorus particles located on the layer directly above. The electrical stimulus is delivered by an external adapter and requires very little energy due to the low electrical resistance factor of the material typically used.

- **Encapsulated Phosphorus:** This layer is where you will find the printed artwork of the display, which emits and intense light when the electrical current passes through it, actually burning the phosphorus particles.

- **Transparent Conductor:** This layer is connected to the external electrical adapter and serves as the ground part of the connection. Only with this polarization can the brightness of the burning phosphorus be obtained. This anode layer is transparent and typically composed of Indian Oxide.

- **Protective Film:** This layer consists of a thin PVC, Polyester or other similar material which serves to protect the underlying layers against humidity and other external elements.

- **AC Adaptor/Driver:** This is an external transformer which reduces and regulates the incoming voltage tension to the appropriate level required by the EL display. The adapter is directly connected to the conductive layers via carbon electrodes. This device typically contains a programmable controller which controls the lighting sequences and timing responsible for creating the animation effect of the display. Typically an adaptor also has input connectors for attaching external control sensors such as light, movement, temperature etc.

Light
There exist various methods of calculating the technical data of any determined light source. These include:

- **Luminous Flux:** Light intensity emitted by any determined element. Measured in lumens (lm).

- **Luminous Intensity:** Light intensity emitted by a monochromatic light source in one direction. Measured in candles (cd).

- **Luminescence:** Light received by the reflection of any one determined surface. Measured in candles per square meter (cd/m_2).

EL technology is capable of producing up to **250lm (135cd/m_2).** To illustrate what this signifies, 100cd/m_2 is considered sufficient for a standard cellular screen display whereas up to 5,000cd/m2 is necessary for lighting in public areas. Other examples include overhead projectors, which typically emit around 1,200lm and video projectors which emit anywhere from 1,000lm to 20,000lm.

These devices normally require an alternate current between 60V and 150V with a frequency between 50Hz and 1000Hz. The light intensity can vary increasing both the voltage and frequency.

Operational Voltage:

- 60V to 120V, for the majority of applications; • 40V minimum and 250V maximum.

Operational Frequency:

400Hz to 800Hz, for the majority of applications; 50Hz minimum and 5000Hz maximum; Frequency changes can alter the color scale.
The conversion of electrical energy into light with EL technology is extremely efficient, with studies showing 80% of electrical energy converted into light, thus producing no heat loss. In comparison, incandescent lighting only converts approximately 20% of electrical energy into light, transforming the rest into heat loss.

Consumption
One of the most significant and positive characteristics of EL technology is its low energy consumption. Use of this technology can result in a reduction of energy usage up to 90%.

Incandescent lamps: between 25W and 500W consumption
Fluorescent lamps: between 4W and 6W consumption
Electroluminescent: 1/16W consumption.

EL display panels consume approximately 2mW/cm_2 (2 milliwatts per square centimeter). This value can be used to calculate the energy consumption for EL display panels of any size.

Maintenance
EL display panels are 100% maintenance free, containing no moving parts. With utilization, the phosphorous particles are slowly burned/used up resulting in a slow degradation in brightness to the point where the unit no longer emits light. See "Lifespan" below for more details.

Durability
EL display panels are highly resistant to humidity and extreme temperatures. The protective layers help to encapsulate the "active" layers of the EL display panel, thus reducing any risk of humidity entering and increasing overall durability. Other important characteristics to EL durability is that there are no delicate components inside thus making EL display panels resistant to shocks from impact.

Lifespan
The useful lifespan of EL technology depends exclusively on the consumption (i.e. burning) of its phosphorous particles. Every time electrical current passes through a phosphorous particle burns up and produces/emits light in the process. The more/brighter light you want to obtain, the more phosphorous particles you need to consume/burn. So, we can say there exists an inverse relationship between EL lifespan and the potential light brightness. This means the brighter the light the shorter the lifespan.

In most common conditions, an EL display panel can function for approximately 10,000 to 15,000 hours. However, recent studies have proven that reducing the luminosity (i.e. brightness) can extend the useful lifespan up to 10 years (around 80,000 hours).

This is possible because consumption of the phosphorous particles is not linear, but exponential, in nature. In other words, after an initial rapid burn rate, the continued consumption of phosphorous particles reduces to an extremely slow rate.
Humidity and ambient temperature also influence the lifespan of EL technology, with lower temperatures providing for increased lifespan compared to higher (i.e. hotter) temperatures. Additionally, the quality of raw materials used in EL panel production are extremely important and influential in guaranteeing a high quality long

lasting final product, and thus and excellent return on investment.

Initialization Control Options

One of the principal characteristics of EL technology is the facility of applying it in diverse situations for a variety of needs, making EL technology virtually limitless in possibilities.

Additionally, we can enhance the value-add of EL technology by integrating external sensing and other initialization control devices. These optional control devices can provide for two significant advantages: increased lifespan by eliminating unnecessary “on” time; and increased impact, thus superseding the expectations of the client by providing an enhanced and controllable solution.
The following are basic control options which can be integrated into EL technology today:

Movement Sensor: This type of external sensor can be used to activate/deactivate an EL display panel based on movement near/at the desired location.

Light Sensor: This type of external sensor can be used to activate/deactivate an EL display panel based on the presence/absence of light (day/night time).

Sound Sensor: The sound sensor transforms incoming sound waves into electrical impulse stimulus, allowing an EL display panel to animate according to the volume and rhythm of the sound

Timer: This mechanism can activate/deactivate an EL display panel based on time. The timer can be programmed to activate/deactivate at a specific time or a specific lapse of time after a certain moment.

External Stimulus: Another method of creating value-add in EL technology is by enhancing the feature-set of the EL display panel by adding features which capture external stimulus. These options are available for high volume jobs and include variables such as temperature and humidity, time and date and other information. Implementation of this type of functionality requires the integration of external sensors into the main AC adapter/driver unit.

3. CONCLUSION

In the final analysis, EL technology can be summarized as providing the following features, advantages and benefits:

- Extremely thin and light weight;
- Highly efficient, transforming 80% of energy into light;
- Economic, utilizing up to 90% less energy than other common types.
- Application on various types of surfaces.
- Flexible, allowing application on irregular shaped objects.
- Unlimited size and application potential.
- Resistant to shocks and vibrations, virtually unbreakable
- Solid-state/No moving parts, extremely high reliability
- High visibility in fog, smoke and up to long distances
- Does not harm the eyes or blind your vision.
- Waterproof and temperature resistant, perfect for indoor/outdoor use
- Made from non-dangerous raw materials
- Maintenance free operation for thousands of hours
- Application of high quality/resolution printed graphics
- High durability and longevity
- Easy to install and clean.