

## Copyright LEDline®

### Cut Sheet

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### Product Description: The Toughest Light Source in the World

LEDline® is linear guidance lighting system. It consists of linear arrays of high intensity (daylight visible) light emitting diodes ("LEDs"). The unique, proprietary design incorporates a heat sink and may include optics, depending on the application requirements. All of these components are fully encapsulated in a clear, durable plastic, a formulation specifically engineered to withstand the challenges of a variety of extreme harsh environments. The LEDline® lamp has a plastic, locking, IP68 rated connector (rated to 20m (65ft) seawater depths for 6 weeks).

#### There are four (4) types;

**LEDlineHB™** an omni-directional system with 6 x LEDs embedded within a clear plastic.

**LEDlineDV™** a semi-directional system with an embedded optical system that focuses most light towards the viewer and 6 x LEDs embedded within a clear plastic

**LEDlineSunHB™** an omni-directional system with 12 x LEDs embedded within a clear plastic.

**LEDlineSunDV™** a semi-directional system with an embedded optical system that focuses most light towards the viewer and 12 x LEDs embedded within a clear plastic

## Product Status

Based on the Company's previous experience LEDline® should meet the technical specifications provided herein.

## Intellectual Property of HIL-Tech Ltd.

HIL-Tech Ltd. "HIL-Tech" or the "Company" is a leader in developing LED-based illuminated in-pavement markings, barrier and sign markings, for airports, roadways, the marine, mining and the military and other markets . Responding to the demands of the transportation industry, HIL-Tech has developed a design and process to encapsulate into solid plastic the brighter and more powerful daylight visible LEDs now available. There are now a number of alternatives. LEDlineDV™ (semi-directional), LEDlineHB™ (Omni-directional) and the new addition to the LEDline® product family, called LEDlineSun™, (sunlight visible) with up to 12 x LEDs. LEDlineSun™ comes in two types LEDlineSunHB™ (omni-directional) with 12 x LEDs or LEDlineSunDV™ (semi-directional) and like the others comes in a variety of standard colours. As before, all LEDline® products are the intellectual property of HIL-Tech. There are several patents pending in respect of this innovative addition to the family of LED-based linear guidance lighting systems. LEDline® is a registered trademark of HIL-Tech Ltd.

## Product Applications

LEDline® was specifically designed to meet the needs of extreme environments like the transportation industry by enhancing the visibility of pavement markings in all conditions that motorists and pilots find a challenge. For example, when illuminated, the LEDline® system can be seen at night, at dusk, under intense rain with the wash of headlamps, under light snow and even in broad daylight. Because LEDline® can be embedded in pavement, slightly below the surface, it is not damaged by snowploughs. Alternatively LEDline® may be used on barriers and signs to highlight them.

The use of LEDs as the light source ensures that the system is energy efficient, long lasting and requires minimal maintenance. Since the encapsulating material was formulated to be tough and resistant to a variety of chemicals (e.g. jet fuel) and other contaminants in the transportation industry, and is corrosion proof, submersible and weather resistant, LEDline® may be deployed in a host of outdoor, industrial or resource-industry environments. It is also suitable for a variety of indoor and commercial uses and may be surface-mounted (e.g. on vertical surfaces) if required.

## Size / Dimensions of Mounting Plate and LEDline® Lamp:

**LEDline® Mounting Plate:** Nom. Size: See Drawing HT-6353

Length: 625mm (24.6")

Width: 48mm (1.9")

Height: 24mm (0.94")

**LEDline® Lamp:** Nom. Size: See drawings HT-6252

Length: 578mm (22.8")

Width: 40mm (1.6")

Height: 23.5mm (0.93")

## Weight:

**LEDline® Mounting Plate and Lamp:** 1.36 kilograms (3 lbs.)

**LEDline® Lamp:** 0.77 Kilograms (1.7 lbs.)

## LED Spacing

The LED arrays are organized into a series / bypass circuit with multiple LEDs. Should one fail prematurely the others continue to function. In LEDlineDV™ and LEDlineHB™, a standard unit contains 6 x LEDs. With LEDlineSun™ products, there are 12 x LEDs within the LEDlineSunDV™ or LEDlineSunHB™ products. Note: Custom orders for different shaped, or smaller units with fewer LEDs are possible with volume orders; please contact HIL-Tech Ltd for pricing.

## Part Number Format for Ordering

The part numbers for LEDlineDV™ (semi-directional) and LEDlineHB™ (omni-directional) are detailed in Attachment A

Optical specifications include:

- Colour — Representing available LED colour choices {R - red, A – airport yellow / amber, G - green, B - blue, W - white}
- Optics — In the LEDline HB™ system, there is **no light optical** system, whilst the LEDline® DV™ styled systems, includes an embedded optical system needed to focus much of the light at low angles towards the viewer, therefore the product becomes semi-directional (at night it can still be seen from other angles, however it is extremely bright if approached from the correct direction).

The DV and HB formats hold true for the LEDlineSun™ products with the LEDlineSunDV™ having 12 x LEDs, with two (2) LEDs in the embedded optical system instead of only one with the LEDlineDV™ (6) LED system. A custom half and half system could also be created with 6 x LEDs within the embedded optical system and the other half (6 x LEDs) like the omni-directional system. Such a system would still be far brighter in one direction, yet could still be seen from the other directions.

## Base Materials Properties

Plastic resin — specifications provided are those of the component's manufacturer.

Complete LEDline® assembly — specifications were developed by HIL-Tech. **At this time, many of these parameters are based on tests performed on the previous generation of encapsulated LEDline® products.**

## Base LED Properties

Specifications provided are those of the LED manufacturer before encapsulation.

**Typical Rated Luminous Intensity for 1W LEDs (High Output Lambertian Type, has no optics unless specified):**

Colour	Typical (lm)
Red	60
Red / Orange	60
Yellow / Amber	42
Green	60
White	115+
Blue	16
Royal Blue	220ml

(The data is based on maximum rated allowable current of 350mA for the 6 x LED system and 700mA. Note there are new LEDs which allow higher current producing even brighter LEDline®)

## **FHWA Road Survivability Test as per the FHWA Report:**

### **LEDline® FHWA Survivability Tests 2012**

The FHWA had some basic survivability tests for 18 solar powered road studs being sold in the USA and LEDline®, to see if the products could provide sufficient light with their solar power collection array / strip and battery, as well as testing some of the parameters for their survivability in the middle of the road. LEDline® and only 1 of the 18 road studs passed these tests.

LEDline® was included within the tests as LEDline® can be powered by mains or via solar power and batteries. However, our solar arrays and batteries are commercial arrays and batteries and they are positioned off at the side of the road, not in the middle of the road with the LEDline®. As such, our solar arrays and batteries are not restricted as to their size, the amount of power they can generate, or the amount of battery capacity to store the power, so LEDline® has far more embedded LED lights within it, so can easily provide the required “minimum luminous intensity value of 1 cd”. (The FHWA tested one of our yellow, 6 x embedded LED lights, easily making the minimum 1 cd. **Note:** This is not a lot of light, especially as even the 6 x embedded LED systems can be seen in daylight and our 12 x embedded LED lights are sunlight visible; so we have more than enough light!)

We believe that the FHWA tests were not complete, since they did not test for;

- snow plough ability, (anything sticking above the pavement in Northern climates like Canada, will be hit by steel snow plough blades scraping along the pavement and will not survive unless they are armoured like the typical 12" (30cm) diameter airfield in-pavement lights. And, despite being installed some 12" - 18" (30cm -46cm) into the pavement, even these types of lights are frequently destroyed when a snow plough blade momentarily catches them, as there is far too much momentum to resist such a blade. Our lights are positioned below the pavement surface so don't oppose the snow ploughs at all, and thus survive.),
- temperatures of -85°Fahrenheit (-65°C)
- water depths greater than 1" (25.4mm), (**Note:** previous generations of LEDline® have been tested by the Canadian Navy to seawater depths of approx. 1000 ft. (+300m) and even our all plastic non-corrosive locking disconnect connector, which connects the LEDline® to its sealed induction, non-contact power pick up connector, is rated IP68 (tested to 65ft (20m) seawater depths for 6 weeks).
- In addition, although there was a Lens Impact strength test (ASTM D4280 2008); which LEDline® easily passed, there was no substantial sudden impact test. HIL-Tech routinely takes a steel pointed brick hammer, (used for breaking brick and concrete in construction), to trade shows, or when it is demonstrating its product, and challenges viewers to hit LEDline® as hard as they can to see if they can break the plastic. We estimate that someone hitting the LEDline® plastic lens, with the pointed end of the steel hammer, is providing a sudden impact force of around 20,000 lbs. per Sq inch. Not only can they not break the plastic, but it is even difficult to see a mark where they hit it. This always impresses the engineers who understand just how tough such a test is. **That's why LEDline® is the toughest light source in the world!**

**Three of the FHWA tests were for strength.**

- **ASTM D4280 2008 Longitudinal Strength Test;** LEDline® had two metal supports under the road studs, placed some 2” (50mm) apart then had a compression test performed on them to see if they survived. When they tested LEDline®, however, instead of duplicating the 2” (50mm) spacing, so that everyone was tested equally, they placed the metal supports at either end of the LEDline®, some 21.5” (546mm) apart, so that when the compression test focussed some 1050 lbs. force on to the middle of the LEDline®, having no support, it bent some 1.9” (48.3mm), so it looked like a banana. **LEDline® passed the ASTM D4280 2008 test as the LEDline® continued to work normally!** However, obviously LEDline® is not designed or meant to bridge anything, so this was a much more severe test compared to everyone else's. Please take a look at the enclosed pictures, which shows the test set up, and the enclosed pictures of the lit banana shaped LEDline®.
- **The compressive strength test;** was also impressive, as they used the same machine to put some 89,000 lbs. force on to the LEDline®, which again passed successfully, so you can be sure that the LEDline® is very tough. (Please see enclosed picture #5.)
- **ASTM D4280 2008 Lens Impact Strength Test With 1 Sample Tested 17 Times at 3% RH and 55C (130F):** The LEDline®, after reaching a temperature of 55C (130F), one (1) hour in a convection oven, was placed on a concrete floor and held horizontal. Whilst at elevated temperatures, a 0.19 kg (0.42 lb) dart fitted with a 6.4 mm (0.25 in.) radius semi-spherical head to drop 475 mm (18 in.) perpendicularly onto the approximate centre of the reflective surface. **ASTM D4280 2008 test, LEDline® passed with no visible damage.**
- **Light Maintenance Extreme Temperature Test:** Sample at -20C for 8 hours light readings taken. Sample at +65C for 8 hours, light readings taken. **LEDline® maintained functionality during extreme temperatures.**

**End Connectors (electrical)**

Each 540mm (21.3”) LEDline® lamp comes with one (1) factory connected, (male part) locking, plastic IP68 connector (rated to 20m (65ft.) seawater depths for six (6) weeks.

**Induction Type;** Mandatory for all in-pavement applications, each 540mm (21.3”) LEDline® lamp requires (for all in-pavement applications) one (1) potted and sealed induction power connector unit with attached (female part) IP68 connector system. This is so that the power distribution line needs no cutting, splicing, connecting, sealing or hard wired connectors in the field. All that is required is to thread one end of the power line circuit through the induction connector hole, and then properly connect the induction connector via the IP68 connectors to the LEDline® lamp and install and connect the line to the custom HIL-Tech Ltd. induction Master Controller and Power Module.

For other applications, where circumstances, surface mounting, or corrosion is not a factor, the IP68 factory installed male part can be connected to an IP68 female part which can then be hard wired into the Power Equaliser and DC wire connections.

**Power Supply:** The custom pulse modulating, induction, and DC and other types of power supplies, varies with application. (Contact HIL-Tech Ltd. for details).

**Limited Warranty (extracts only.)**

**No Warranty applies to any goods shipped by HIL-Tech until they have been fully paid for.**



If fully paid for, LEDline® has a **Limited Warranty of 1-year on parts only, from the date of the delivery shipment.** All returns must have and be accompanied by a pre-authorized return goods authorization (RGA) number obtained from HIL-Tech Ltd., prior to such return, or the returned goods will not be accepted. Credit for any goods returned AND accepted under the Limited Warranty, may be granted once the goods have been inspected. **Under no circumstances will HIL-Tech Ltd. or its successors be responsible for any collateral, consequential or installation damages.**

**For a complete copy of the Limited Warranty details, please contact HIL-Tech Ltd.**

### **Specifications May Change**

All information contained herein indicates the preliminary specifications for LEDline® products and accessories. Specifications related to the plastic encapsulation material are derived from those determined from tests conducted on other LEDline® products that use the same material. Specifications of component materials are provided by the manufacturer(s) of the particular component. Any of this information may be changed at any time without notice.

### **No Liability**

Notwithstanding that HIL-Tech has, to the best of our knowledge and belief, provided accurate information herein, HIL-Tech assumes no responsibility for the accuracy or completeness of representations made by component manufacturers, nor for any expressed or implied recommendations concerning LEDline® LEDlineDV™ or LEDlineHB™ products, made by others. Before utilizing the any LEDline® systems, products, accessories or ancillary equipment, all prospective users should evaluate the suitability of said systems, products, accessories and ancillary equipment for their own intended uses or purposes and should draw their own conclusions. The user assumes all risks and liabilities in connection with such use or uses.



## LEDline® PART NUMBERS

All Parts are LL-\*\*\*\* - \*\*\*\*\*-xx for LEDline® generic product.

**Lamps:** Example: **LL – DV00 – 0003W-12** = LEDlineDV™ with directional optics, with an Induction connector in the colour white.

1<sup>st</sup> Pair = Choice of Optics

DV = With directional optics  
HB = No optics

2<sup>nd</sup> Pair = is for the sunlight visible variant S with the number of LEDs, 6 x LEDs, or 12 x LEDs

S0 = Sunlight visible  
**LL – HBS12 – ICW0** = LEDlineSunHB™ (omni-directional) with 12 x LEDs optics, with an Induction Connector in the colour white.  
**LL – DVS12 – ICW0** = LEDlineSunDV™ (semi-directional) with 6 x LED directional optics and 6x LED (omni-directional), with an Induction Connector in the colour white.  
**LL – DVS6 – ICW0** = LEDlineSunDV™ (semi-directional) with 6 x LED directional optics and with an Induction Connector in the colour white.

3<sup>rd</sup> Pair = Connector Type

IC = With Induction Connector  
00 = no Induction Connector, (with standard 3m length of wire) anything over 3m has an extra charge. (contact HIL-Tech)  
Length can be specified here in m.  
P1 = Power equalizer (for Dc power supplies only)  
P2 = Power equalizer with addressable DMX  
**LL – HBS12 – 06W0** = LEDlineSunHB™ (omni-directional) with 12 x LEDs optics, with 6m\* wire in the colour white. \*There is an extra charge.

4<sup>th</sup> Pair = Colour Code. It is possible to have two colors specified in one LEDlineSun™ unit 6 x LEDs of one colour and 6 x LEDs of another.

W0 = White  
Y0 = Yellow  
B0 = Blue  
R0 = Red  
G0 = Green  
IR = Infra Red  
**LL – HBS12 – 06WR** = LEDlineSunHB™ (omni-directional) with 6 x white LEDs and 6 x red LEDs, with 6m\* wire in the colour white.\*There is an extra charge.

**Power System Example: LL-PSMC-0000**

1<sup>st</sup> Pair = Power System = PS

2<sup>nd</sup> Pair = Type of System

MC = Master Controller  
PM = Power Module

3<sup>rd</sup> Pair = Power Module System Configuration

01 = Use with less than 20 LEDline® Units  
02 = Use with 20 or more LEDline® Units

4<sup>th</sup> Pair = Spare pair of digits for future use

00 = Spare

