

----- LEDline® linear LED guidance lighting

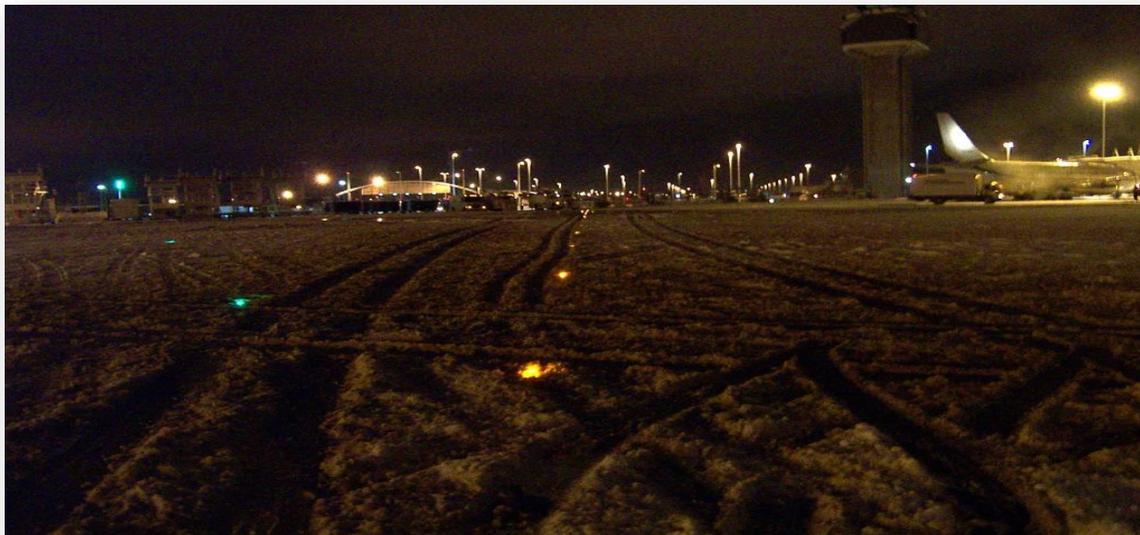
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LEDline® Cut Sheet
Oct. 2021

Contents

June 2021 1
LEDline® product Description:3
Waterproof Connector:5
 Product Specifications:.....6
 Dimension of a LEDline® Unit:6
 Electrical:9
IP69K Connector: 11
 Technical Specs– Field Wirable Connectors 12
Appendix 1: Installation Drawings: 15
 Drawing Not to Scale:..... 15
Appendix 2: LEDline® part numbers..... 15
Appendix 3: FHWA Strength Tests **Error! Bookmark not defined.**

LEDline® in Deep Snow at Anchorage International:

Highly visible linear, yellow LED, LEDline®, with (6 x LEDs) and standard, green, FAA (**30% light, 70% heat, incandescent bulb**) point source taxiway lights. Because of the heat, the FAA taxiway lights melts snow, as does the LED the LEDline®, **without needing any additional heating elements!**



LEDline® at Vancouver International's De-icing Pads. (Installed Fall 2009, still going strong Sept 2021, despite never having being turn off, so working 24/07 for +11 years).



LEDline® Used for Helipad Visual Aids.

LEDline® In the USA (Copyright Bruce Lomesky).



LEDline® In Australia (Copyright Peter Simpson of PSNK Aeronautical Services).



LEDline® Being Snow Ploughed; on the Ontario 403 Freeway. (The picture is taken from the video).



Product Description:

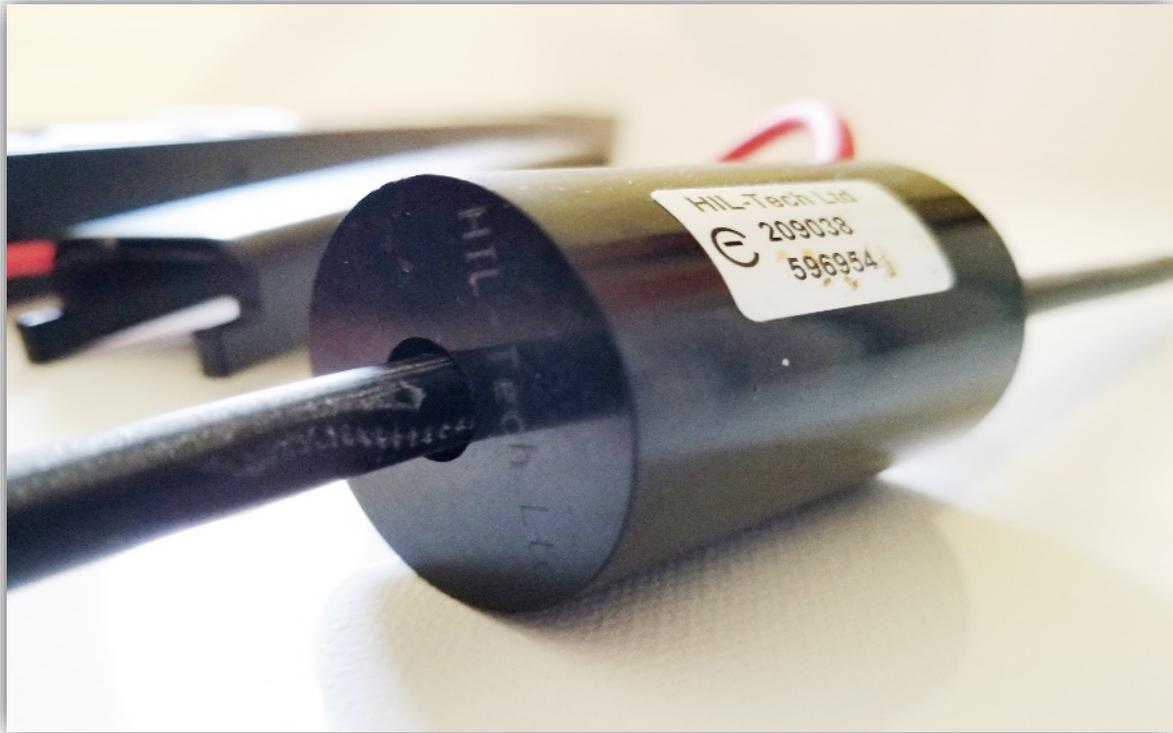
LEDline® is linear visual aid guidance lighting system, so each unit indicates both the position and the direction to travel. It consists of linear arrays of high intensity (daylight visible) light emitting diodes ("LEDs"). The unique, proprietary design, incorporates a heat sink and includes custom precision optics, depending on the application requirements. All of these components are fully encapsulated in a solid, durable clear matrix, a formulation specifically engineered to make it submersible, chemical and weather resistant, and able to withstand the challenges of a variety of extreme harsh environments. For more details see www.ledline.net

Whilst LEDline® can be powered via solar arrays or Dc current, for in-pavement applications, LEDline® is 90 – 220VAC 60Hz mains powered via an induction, non-contact, (no hard wired), low powered series circuit.

With the LEDline® induction power pick up connectors, it makes no difference if the environment is wet, salt laden, or if the product is covered with chemicals like glycol or other airfield de-icing fluids, as the LEDline® and the glue buried non-contact power connectors, are also completely submersible. With a low powered AC series circuit, power is induced into the LEDline® lamps via the completely sealed, never cut or splice power cable and induction connector.

The direct burial power line, bringing power to the lights, is never cut or spliced, as such, it continues to have all the manufactures full cladding and protection, extending its life, and preventing corrosion.

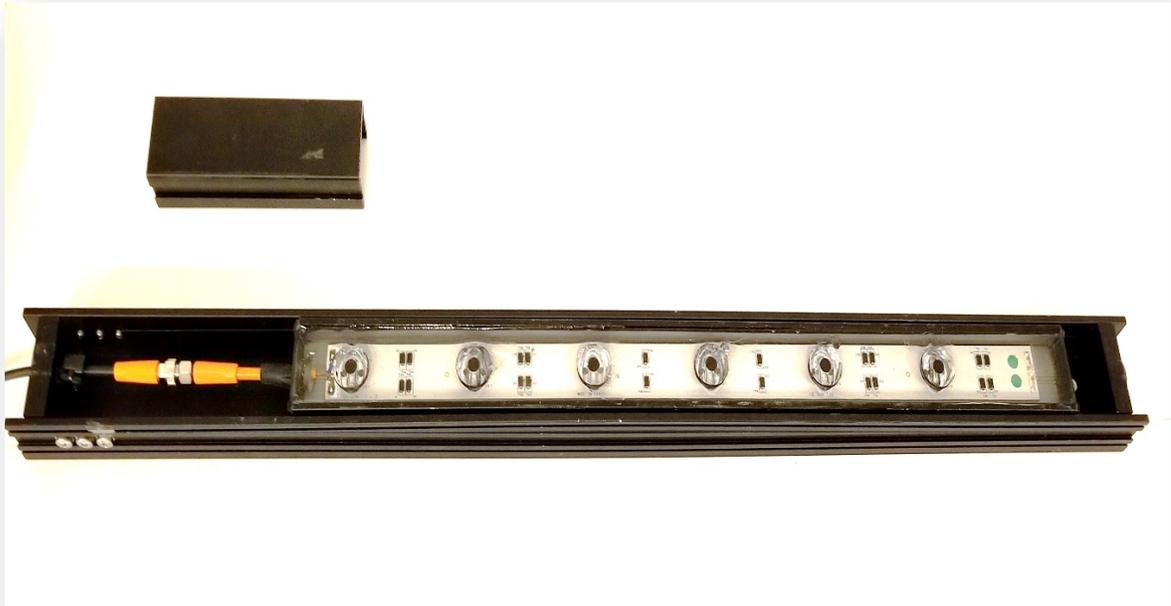
Non-Contact (no Hardwiring) Induction Power Connectors



Non-Contact (no Hardwiring) Induction Power Connectors



Unlit LEDline® Omni-directional Unit, with its IP69 Quick Disconnect Connector.



Waterproof, Submersible, Quick Disconnect Lamp Connector: For easy lamp maintenance, each LEDline® lamp unit, comes with a quick disconnect, nickel plated brass or stainless steel, locking, screw together, IP69 waterproof connector. IP69K Specifications = “Protected against ingress of dust and high temperature and close-range high pressure, high temperature spray downs”. This connector allows the non-contact induction power connector to be buried in the glue, yet, should a replacement LEDline® lamp be required, the highest rated IP69K connector, is easily accessible for the replacement of the LEDline® unit.

**IP69 Quick Lamp Disconnect
Connector:**



Product Specifications:

LEDline® was designed to meet the needs of extreme environments like the transportation industry, by enhancing the visibility of pavement markings in all conditions that pilots or motorists find a challenge. When illuminated, the LEDline® system can be seen; at night; at dusk; under intense rain; with the wash of headlamps; under some +178mm (7") of snow, (it melts holes in snow); and in sunlight. The twelve (12) embedded LED system, meets all the previous conditions and is even more visible in daylight / sunlight.

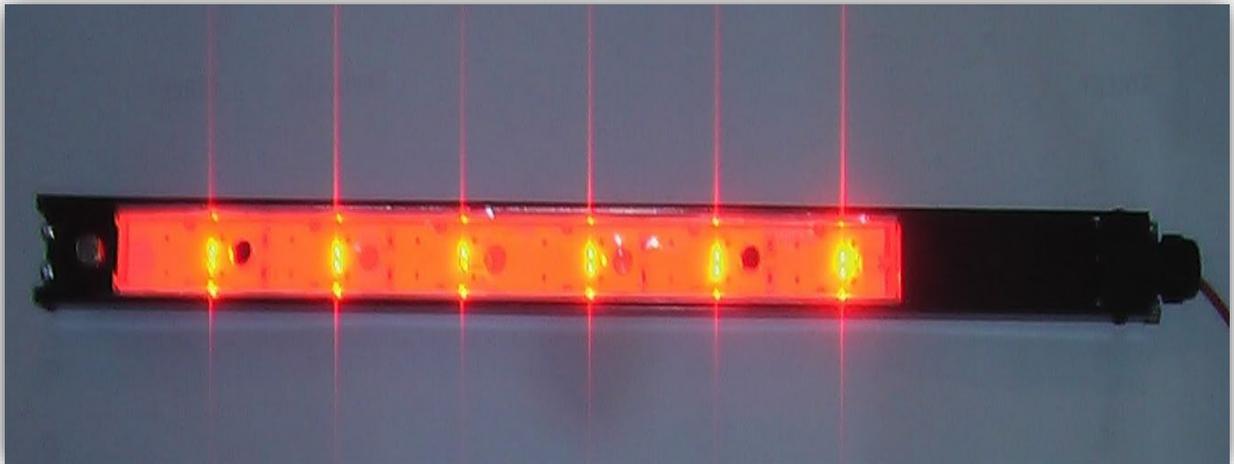
LEDline® products come in a variety of standard LED colours for airfields, helipads, road, or military use. **Custom LEDs with IR (Infra-Red) or UV (ultra violet) spectrum can also be ordered.**

There are a number of alternative LEDline® visual aid products;

- LEDlineDV™ (semi-directional) with six (6) embedded LEDs,
- LEDlineHB™ (Omni-directional) with six (6) embedded LEDs,

And, the LEDlineSun™ product family (sunlight visible) has up to twelve (12) x embedded LEDs within the clear solid matrix. This is by far the brightest system and is for suitable for sunlight visible applications. LEDlineSun™ comes in two types;

- LEDlineSunDV™ (Semi-directional) with twelve (12) x embedded LEDs
- LEDlineSunHB™ (Omni-directional) with twelve (12) x embedded LEDs



Dimension of a LEDline® Unit:

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

Height: 23.5mm (0.93")

The LEDline® Lamp Unit within the In-Pavement Mounting Plate: Nom. Size:

See Drawing HT-6353 Length: 625mm (24.6")

Width: 48mm (1.9")

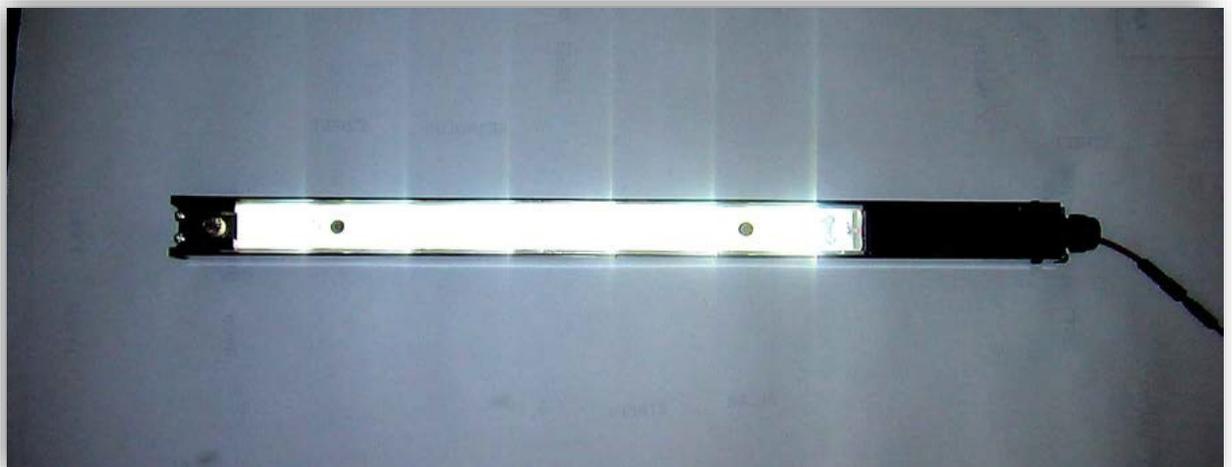
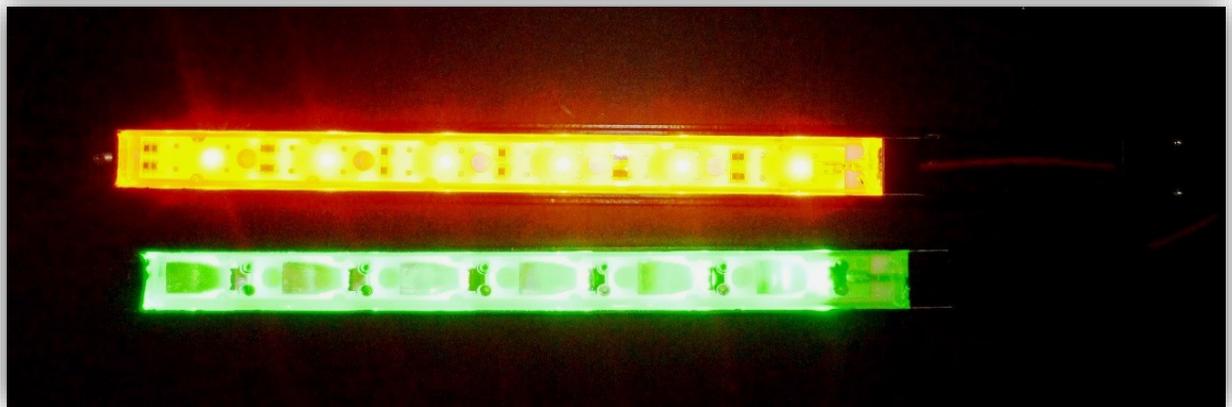
Height: 28.5mm (1.1")

Weight:

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

LEDline® Lamp: 0.77 Kilograms (1.7 lbs.)

LED Colour Options: Any colour of LEDs can be used within LEDline®, including Infra-Red (IR) or Ultra Violet (UV), although the latter two colours are custom special-order units.



Both LEDlineSunDV™ (semi-directional) and LEDlineSunHB™ (omni-directional) products are sunlight visible and have twelve (12) x LEDs embedded within the product's clear matrix.

The LED arrays within the solid clear matrix are organized into a series / bypass circuit. As such, should one LED fail prematurely, the others will continue to function normally.

Survivability and Unusual Tests: LEDline® is embedded into the pavement flush with the surface, so it is not damaged by snow ploughs as they pass over it. And, since the LEDs with their precision optics being completely embedded within HIL-Tech's custom clear matrix, LEDline® is extremely tough; impact resistant; submersible, and thus completely waterproof. (Please see our web site for a demonstration of how tough and impact resistant LEDline® is when placed on top of the road surface and then repeatedly rolled over by a 10 Ton roller. This demonstrates just how tough LEDline® is since it is normally always mounted flush with the pavement surface).

Below September 2012 LEDline® was placed on the surface of a nearby road being redon and a 10 Ton (20,000lbs) roller went over it many times. The video is at www.ledline.net or www.ledline.ca





Temperature: Previous LEDline® fixtures have been tested from -55C° (-67° Fahrenheit) to +65C° (+149° Fahrenheit) with no effect on the fixtures.

Canadian Navy Submergibility Tests: Early LEDline® product was successfully tested for use in the escape chambers of submarines at the Canadian Naval Engineering Test Establishment in Montreal. It was so successful that it was then used as a light within the pressurization test chamber. As of 28th April 2014, the LEDline® there had cycled over +5000 times at seawater depths down to 300m (1000ft.). I believe that the units continue to function, so who knows how many pressurizations and de-pressurizations the units have now undergone? For verification, please contact Mr. Steve Mauchan Tel: 1 514-366-4310 Ext: 415 E-mail: Stephen.Mauchan@nete.dnd.ca.

Base Materials Properties: Custom proprietary crystal-clear matrix specifications not provided.

Energy Efficient: 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; submersible, corrosion and weather resistant, LEDline® may be deployed in a host of outdoor, industrial or resource-industry environments. Note: It is also suitable for a variety of indoor and commercial uses, and may be surface-mounted on any vertical surfaces.

Complete LEDline® Assembly: The above specifications were developed by HIL-Tech based on successful tests performed on the previous generations of encapsulated LEDline® products. Because they are so extreme, such tests would not normally be repeated, unless today's product was used for similar extreme environments.

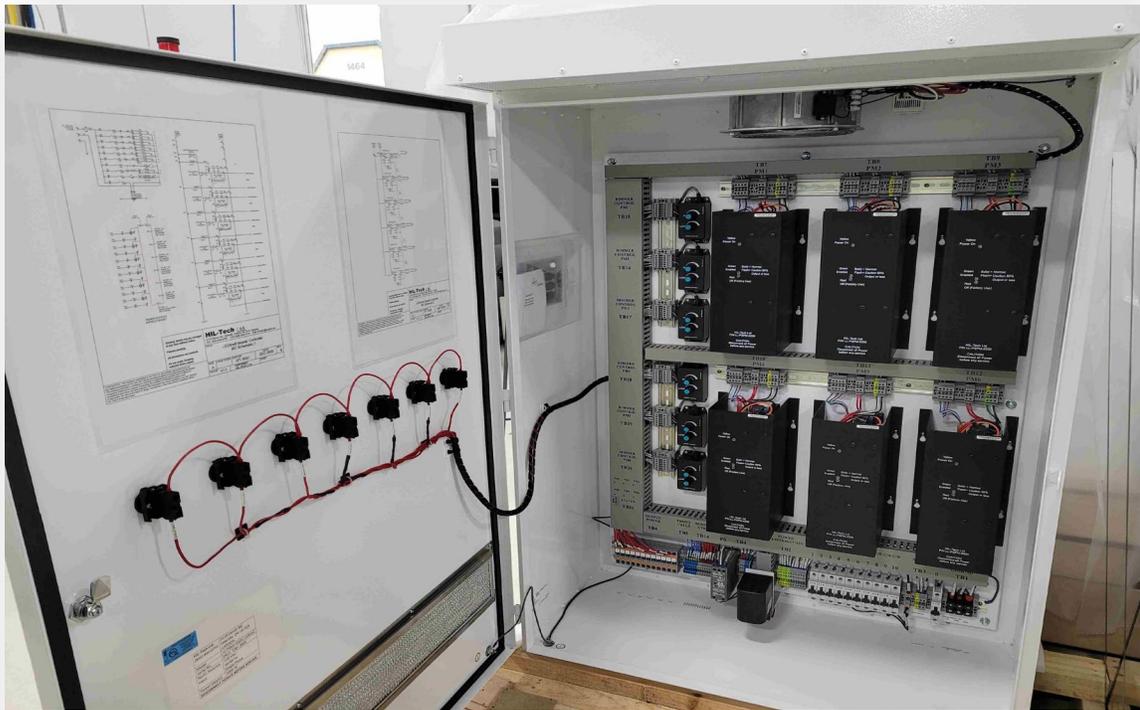
Electrical:

LEDline® lamp units are RoHS certified and are usually induction powered (no hard wiring of the connections) and are low powered. The 12 x LED system uses only 19 - 21VAC (depends on LED colour) at 700mA, whilst the 6 x LED system uses 19 – 21VAC at 350mA.

Power Supplies: LEDline® units can be powered by any type of power from; mains; VDC power;

or renewable energy like wind and / or solar power generation, with batteries, as the units work with either AC or VDC power.

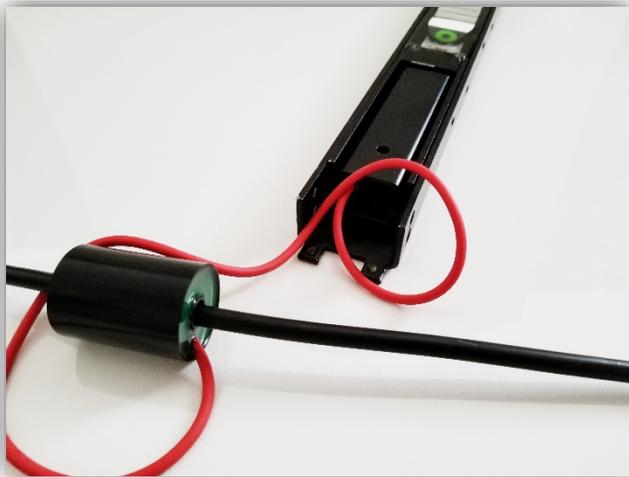
**For In-Pavement Applications Power Must Be by Induction Master Controllers:
Induction Master Controller, with Six (6) Independent Induction Power Modules, Each Able
to Power Up a Separate Induction Circuit.**



**Induction Master Controller with Two Induction Power Modules, Lighting Old Style LEDline®
with induction power connectors**



The Master Controller Power Modules, contain custom pulse width Power Modules which takes any power from 90VAC – 220VAC and turns it into the correct low power series circuit voltage, suitable for LEDline® units. There are VDC and other types of power supplies, which vary with application. (Please contact HIL-Tech Ltd. for details).



Note: All power supplies, including the induction Master Controller, are individually CSA inspected and certified to conform to electrical standards for US (UL), Canadian (CSA), and / or European (CE) certifications.

Induction Power Supply, with Induction Non-Contact Power Connectors: Induction powered and connected lamps are required for all in-pavement applications where vehicle is driving over the lamps. The induction system is by far the most robust electrical connector, since it functions regardless of any vehicle vibration, water or moisture. In addition, since there is no hard wiring or connecting required, it allows the direct burial wire, bringing power to the lamps, to remain pristine and uncut, to continue to have all of its factory cladding intact, thus preventing corrosion.

Each LEDline® lamp requires one (1) completely sealed induction power connector unit with its attached IP69K (female part) connector system.



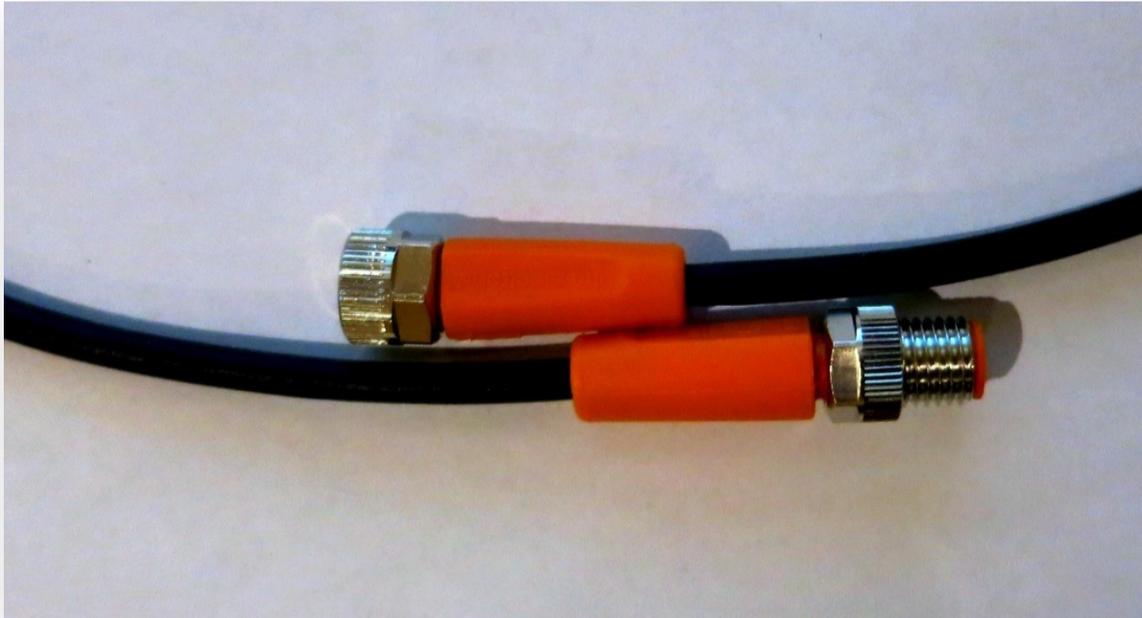
DC Power Supply: For surface mounting or possible other applications, where corrosion is not a factor, a HIL-Tech DC power supply can be used. For hard wired DC powered LEDline®, all connections need to go through a HIL-Tech Power Equalizer, to counteract the VDC line voltage drop, so that the last light on the circuit is as bright as the first. In addition, with each lamp being hard

wired, such connections can also have DMX signal computer controls, so individual computer control of the LEDline® lamps can be achieved.

Renewable Energy Power Supply: LEDline® can be powered via solar panels; wind power and batteries. For northern climes it is recommended that a propane backup generator is included to top up the batteries when solar or wind fail.

LEDline® End Connectors (electrical): Each LEDline® lamp comes with one (1) sealed (male) IP69K locking, quick disconnect connector. The IP69K connector has a locking nickel coated brass screw and is the highest possible IP rating connector available. There are stronger deep sea pressure connectors available, if these are required, please contact HIL-Tech for details.

IP69K Connector:



Operating voltage:	Without LED: 50 V AC / 60 V DC
Current rating:	3A
Protection rating:	IP69K = Protected against ingress of dust and high temperature and close-range high pressure, temperature spray downs.
IP69 Test	(On a rotating turntable, with a speed of 5 ± 1 revolutions per minute, the test requires a spray 4 "– 6" (101mm-152mm) from the product of 4 gallons/16 liters per minute with water pressure of between 1160-1450 psi, at a temperature of 176°F/80°C. The heat and spray must not cause damage. The IP69K rating is the highest protection available, unless custom deep-sea connectors are required. Please contact HIL-Tech for technical specs. on any required deep-sea connectors).
Tightening torque:	0.3...0.5 Nm
Ambient temperature:	-25...90 °C
Flex rating:	> 5 million cycles
Material body:	TPU housing, Viton O-ring
Material coupling nut:	Nickel- plated brass
Cable:	PUR, halogen-free, 24 AWG conductors, Ø 3.7 mm
Approvals:	cURus and RoHS standards

Technical Specs– Field Wirable Connectors

Operating voltage:	60 V AC / 75 V DC
Protection rating:	IP69
Ambient temperature:	-25...90 °C
Material body:	Nickel-plated brass (L33600, L33601, E18216, E18218) PA (L33602, L33603, E18217, E18219)

Material Coupling Nut: Nickel-plated brass

Cord Set Features:

- Cordsets feature a "Lock-in-Place" coupling nut that resists high levels of shock and vibration
- Cordsets offer high-flex PUR-jacketed cable rated for over 5 million flex cycles

- A special insert design includes a mechanical end stop preventing damage to Viton O-ring from over-tightening
- Cordsets are designed and tested to resist harsh conditions in industrial automation

Please Note: For those requiring connectors for submersible deep-sea applications, there are other custom deep-sea connectors available. Please contact HIL-Tech for details.

Direct Burial Wire: For the induction wire, a direct burial wire type should be used #8 (USA) RWU gauge wire (= #35 metric wire gauge MAX O.D. of insulation 7.9mm (0.31”)) suitable for direct burial. According to local codes, measure off the complete wire run distance, (not forgetting to add in the amount to reach the power supply) and then double this distance to have sufficient wire to create a complete unbroken loop over the entire distance. (i.e., if the distance is 200m. (656ft.), and another 10m (32ft.) is needed to cross the road to the power supply, then the wire loop distance needed would be 420m. (1,377ft.)).

Depending on the number of LEDline® units required to be lit and the impedance of a circuit, a single Power Module should be able to power some 30 x LEDline® units, over a 700m (2,296ft.) circuit. Greater the circuit distance and impedance, the fewer the number of LEDline® units can be lit. (Contact HIL-Tech for guidance).

Please Note:

- In order to minimize any corrosion, **the direct burial power line circuit wire must be continuous, without breaks, joints or connections of any kind and each wire run must start and end at the same particular Power Module.**
- **The wire loop circuit, must also be closely tied together with plastic ties every 30cm (12”) to minimize any impedance / EMI emissions.**

A Mechanical Installation Preparation Checklist (Aug. 2017): Is available from HIL-Tech Ltd.

Intellectual Property of HIL-Tech Ltd.: HIL-Tech Ltd. is a leader in developing LED-based illuminated in-pavement, barrier and sign markings for; airports; roadways; the marine; mining; military and other markets. Responding to the demands of the transportation industry, HIL-Tech Ltd. has developed a design and process to encapsulate the brighter and more powerful daylight visible LEDs into a solid, clear matrix.

All LEDline® products are the intellectual property of HIL-Tech. There are patents and 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 Status: Based on the Company's previous experience LEDline® should meet the technical specifications provided herein.

Specifications May Change: All information contained herein indicates the preliminary specifications for LEDline® products and accessories. Specifications related to the matrix 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.

Limited Warranty (extract only): If the product has been fully paid for, LEDline® has a standard 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.**

Additional Years Limited Warranty: An additional one (1); two (2); or three (3) years **Limited Warranty is available** and this additional **Limited Warranty** may be purchased at the time of order. Please contact HIL-Tech Ltd. for details.

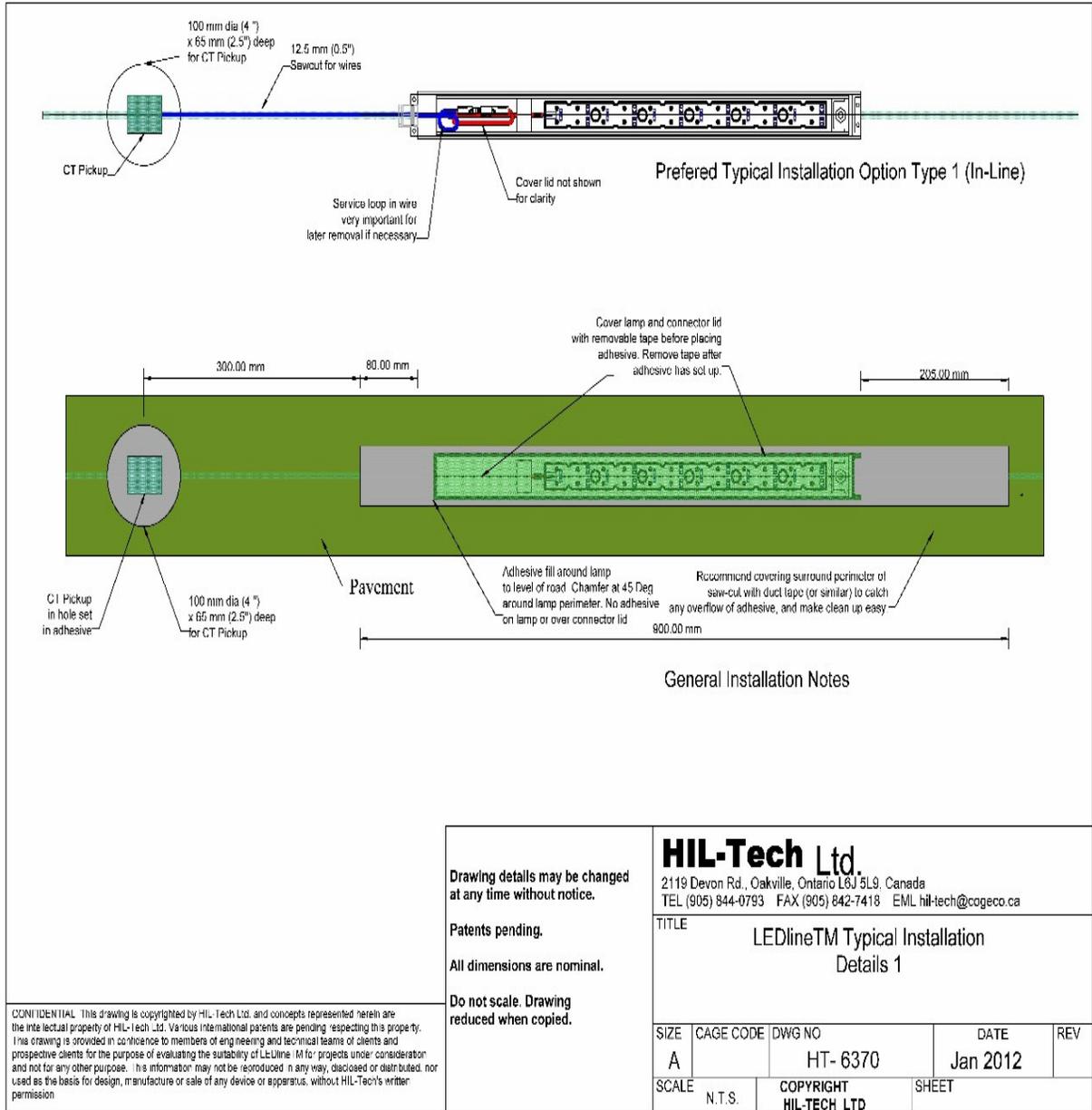
No Liability:

Notwithstanding that HIL-Tech has, to the best of its knowledge and belief, provided accurate information herein, HIL-Tech assumes no responsibility for the accuracy or completeness of representations made, nor the accuracy or completeness of representations made by component manufacturers, or for any expressed or implied recommendations concerning LEDline® products. 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.

Appendix 1: Installation Drawings:

There is a separate more detailed installation guideline write up, so please ask HIL-Tech Ltd. for a copy.

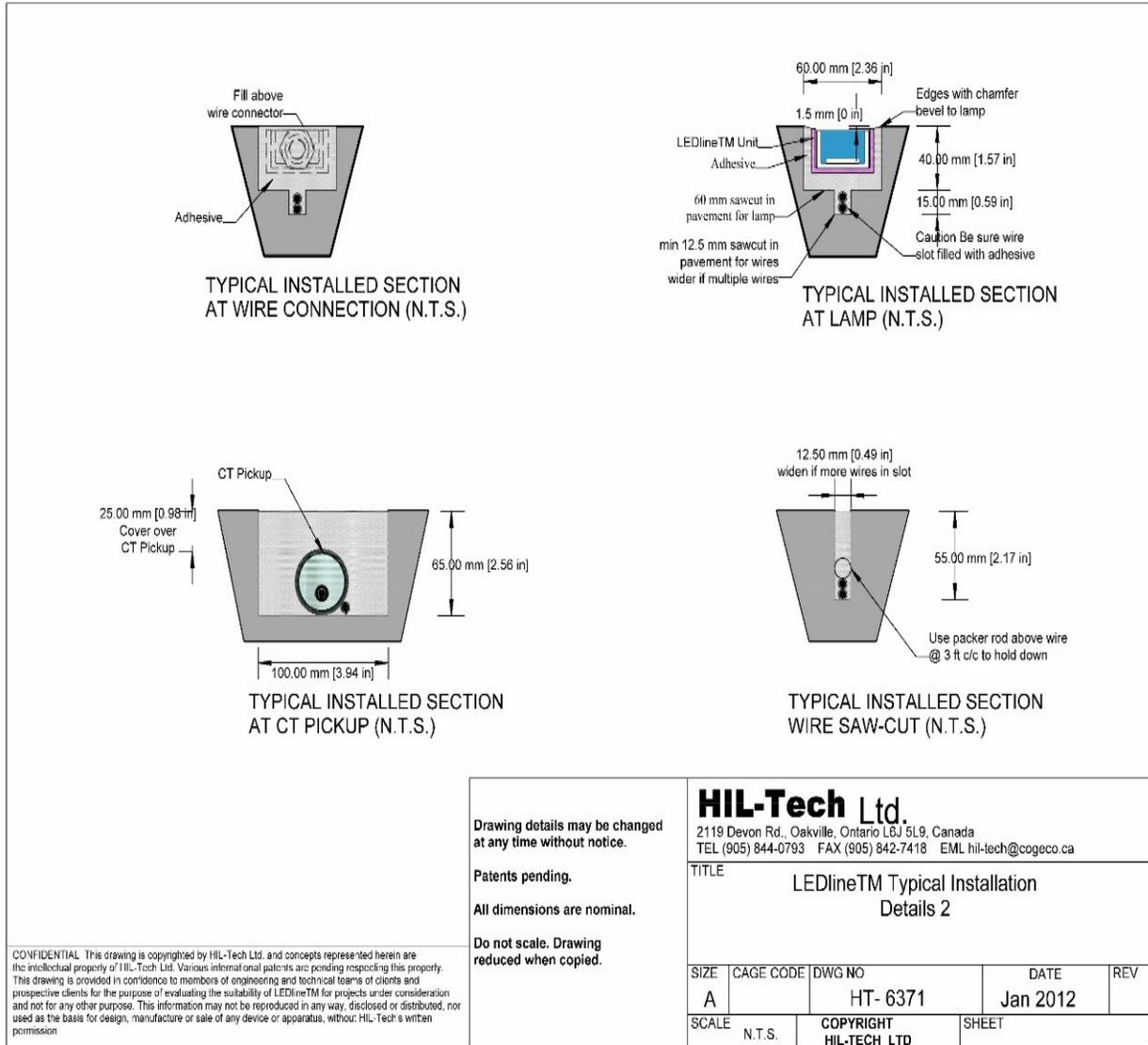
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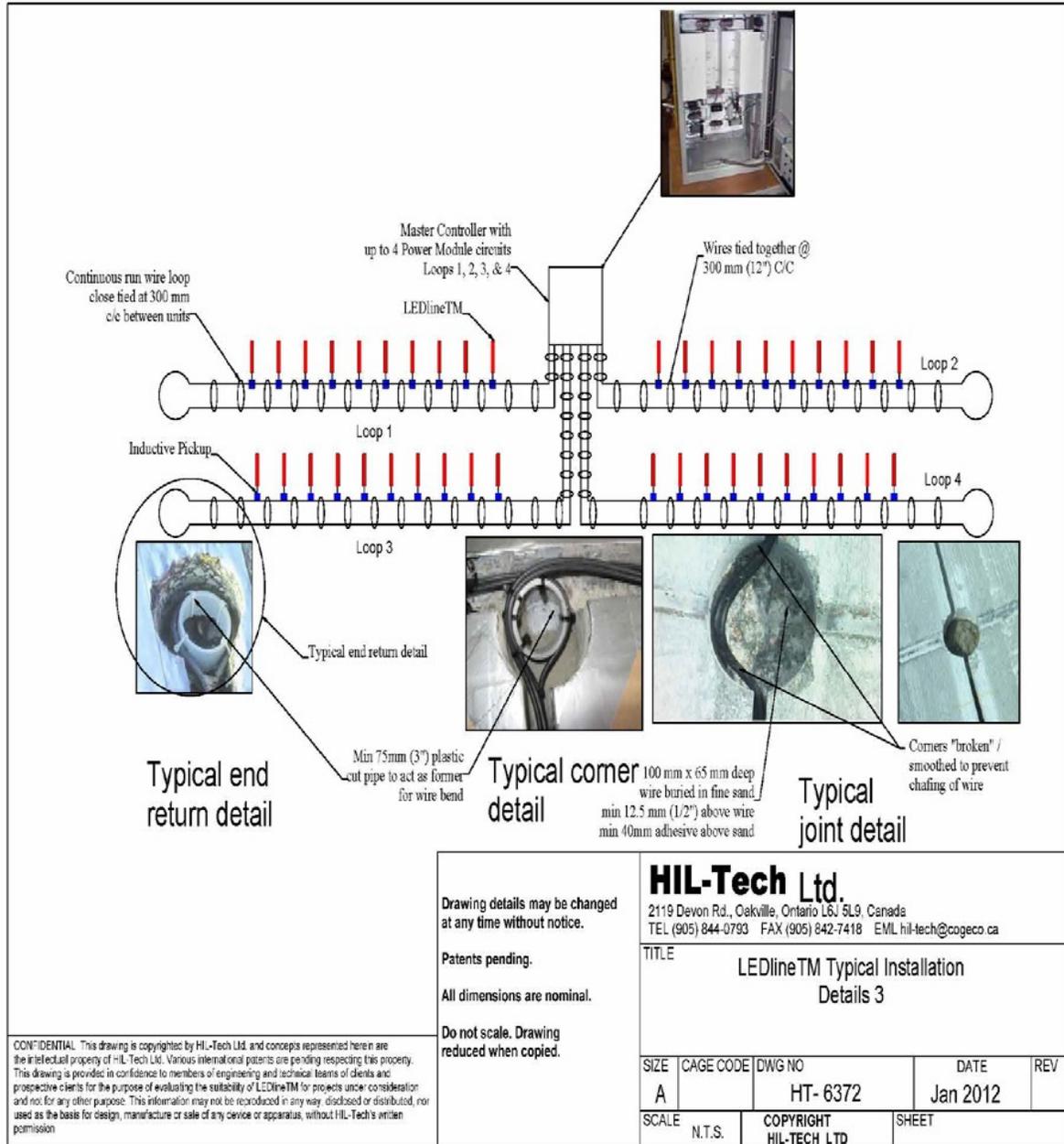
<p>Drawing details may be changed at any time without notice.</p> <p>Patents pending.</p> <p>All dimensions are nominal.</p> <p>Do not scale. Drawing reduced when copied.</p>	<p>HIL-Tech Ltd. 2119 Devon Rd., Oakville, Ontario L6J 5L9, Canada TEL (905) 844-0793 FAX (905) 842-7418 EML hil-tech@cogeco.ca</p> <p>TITLE LEDline™ Typical Installation Details 1</p>																				
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N.T.S.																					

Typical saw cut depths for the lights and induction power distribution cables: **Please Note;** the induction power cables can also be separated from the lamps, please see the more comprehensive details in our standard Installation guidelines.

Drawing Not to Scale:



Typical Induction Circuit:



<p>Drawing details may be changed at any time without notice.</p> <p>Patents pending.</p> <p>All dimensions are nominal.</p> <p>Do not scale. Drawing reduced when copied.</p>	<p>HIL-Tech Ltd. 2119 Devon Rd., Oakville, Ontario L6J 5L9, Canada TEL (905) 844-0793 FAX (905) 842-7418 EML hil-tech@cogeco.ca</p>			
	<p>TITLE LEDlineTM Typical Installation Details 3</p>			
<p>SIZE A</p>	<p>CAGE CODE</p>	<p>DWG NO HT- 6372</p>	<p>DATE Jan 2012</p>	<p>REV</p>
<p>SCALE N.T.S.</p>	<p>COPYRIGHT HIL-TECH LTD</p>		<p>SHEET</p>	

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Appendix 2: LEDline® PART NUMBERS

Part Number Format for Ordering

The part numbers for LEDlineDV™ (semi-directional) and LEDlineHB™ (omni-directional) are detailed in the Attachment Optical specifications which 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 an omni-directional light optical** system, whilst the LEDline® DV™ styled systems, includes **an embedded semi-directional optical system** needed to focus much of the light at low angles towards the viewer. The product therefore, becomes semi-directional, (at night it can still be seen from other angles, however it is extremely bright if approached from the correct direction).

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.

1st Pair = Choice of Optics

- | | | |
|----|---|-------------------------|
| DV | = | With directional optics |
| HB | = | No optics |

2nd 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. |

3rd Pair = Connector Type

- | | | |
|----|---|--|
| IC | = | With Induction Connector |
| 00 | = | no Induction Connector, (with standard 3m length of wire) anything over 3m has an extra charge. (Please contact HIL-Tech for the price) |
| | | 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. |

4th 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

1st Pair = Power System = PS

2nd Pair = Type of System

- | | | |
|----|---|-------------------|
| MC | = | Master Controller |
| PM | = | Power Module |

3rd Pair = Power Module System Configuration

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

4th Pair = Spare pair of digits for future use 00 = Spare