

# **Technical Information**

## *Lighting – Interior Lighting Systems*



*Ideas today for  
the cars of tomorrow*

## Hella interior lighting systems

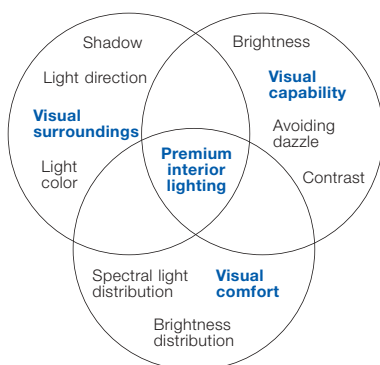
It has frequently been confirmed that we are spending more and more time in our cars. It is therefore logical that our requirements for convenience and safety are continuously increasing. This applies particularly for trips during the evening and night hours, which, in the meantime, account for nearly one-quarter of the entire driving time. Here a driving environment with minimum stress and fatigue is highly significant.

To satisfy the increasing requirements placed on automotive interior lights, Hella with Hella Interior Lighting Systems established the Interior Lighting Competence Center in 1998 within the worldwide Hella Corporation. Primary features and objectives are:

- First-class development partner for all brand-name automobile manufacturers and their suppliers
- State-of-the-art technology
- Exceptional know-how
- Exemplary service

The interior illumination from Hella Interior Lighting Systems satisfies all drivers' requirements regarding light functions while simultaneously taking into consideration customer desires for individualism. The competency ranges from knowledge of the physiology of the human eye to photometric competency in optical systems and light sources right up to integration of complex BUS controls. With this comprehensive know-how, which also specifically utilizes knowledge from the entire corporation, we are realizing the vision of "light experience in your car".

## Significance of interior lighting



## Quality characteristics for interior lighting

The interior lighting in automobiles supports primarily central features in and on the vehicle in the dark:

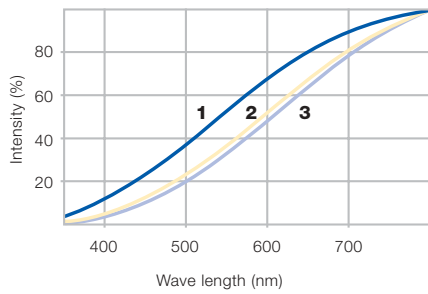
- Orientation and sense of well-being
- Quick identification and location
- Reading and operating
- Safety and convenience

In developing, designing and optimizing our products we focus particularly on the following features in addition to the functions themselves:

- Non-dazzling illumination
- Lights with maximum design standards
- Physiological aspects
- Legal requirements and customer specifications

## Light sources

Incandescent bulbs are the most economical light source and are therefore still the most frequently used standard. However the increasing requirements for installation space, service life, light color and design are increasing the demand for LEDs continuously. In contrast, other light sources such as electro-luminous foils (EL foils) and cold cathode fluorescent lamps (CCFL) will continue to be used only for special applications in the future.



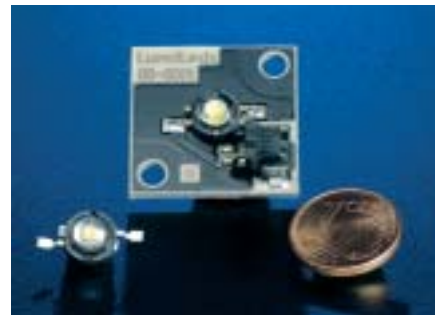
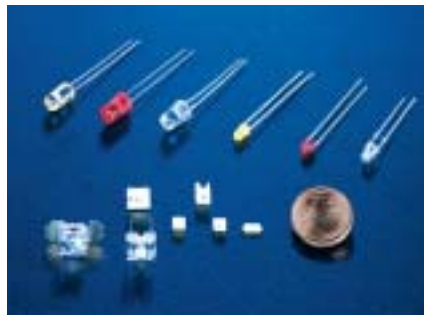
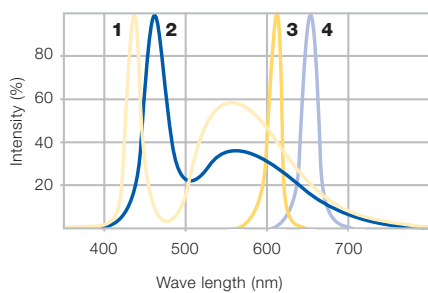
**Spectral distribution, incandescent bulbs:**

**Standard incandescent bulbs**

**Versions of incandescent bulbs**

- 1. Halogen**
- 2. Xenon**
- 3. Standard**

LEDs are available in various colors. Special features are the low power, minimum installation space and high service life, meaning that replacement of an LED during the life of the car is eliminated. Standard Hella interior lighting modules use various types of LEDs in large quantities.



**Spectral distribution, LEDs:**

**Standard LEDs**

**High performance LEDs**

- 1. Cold white (9.500 K)**
- 2. Warm white (4.800 K)**
- 3. Orange (604 nm)**
- 4. Red (640 nm)**

Light source		Output	Luminous flux	Efficiency	
Incandescent bulb	Standard	5 W	50 lm	10 lm/W	
	Xenon	6 W	85 lm	14 lm/W	
	Halogen	6 W	120 lm	20 lm/W	
LED	5 mm	yellow	0.04 W	0.8 lm	20 lm/W
		white	0.08 W	1.0 lm	11.7 lm/W
	Power TOPLED®	yellow	0.12 W	2.4 lm	20 lm/W
		white	0.13 W	1.9 lm	14.6 lm/W
	Piranha	yellow	0.175 W	3.2 lm	18.3 lm/W
	Luxeon®	yellow	1.0 W	36 lm	36 lm/W
		white	1.2 W	25 lm	20.8 lm/W

**Light sources in comparison**

**Reflectors**

In addition to the light source, the geometry and surface of the reflector is decisive for the brightness of a light.

Hella Interior Lighting Systems develops reflectors specifically to meet requirements for styling and installation space. Four types of reflectors are used depending on the light functions:

- Painted reflectors
- Metallised reflectors
- Untreated reflectors
- Sheet metal reflectors



**Painted reflector**



**Metallised reflector**



**Untreated reflector**



**Sheet metal reflector**

## Lens patterns

Lens with optical patterns fulfill the following functions:

- Homogenous dispersion of the light coming from the reflector at a defined angle without creating irritating color effects
- Increase in the quality of the light
- Light cover as a design element

The lens can also be used to guide the light, with or without use of a reflector.



**Product versions with different types of lens**

## Fiber optic light guides

Fascinating possibilities for light design in vehicle passenger compartments are being opened up by the increasing illuminating power of LEDs and the development of high-tech, complex fiber optic light guides by Hella Interior Lighting Systems. Thanks to intensive research and patented development, Hella Interior Lighting Systems has reached a position of worldwide leadership in this sector. According to our estimates, the use of this applications will increase immensely during the next few years.

We differentiate fiber optic light guides into four functional categories:

Light aperture	Application examples	
	ambient	functional
Spot	Center console illumination	Reading light
Line	Door mirror illumination Handle illumination	Map compartment illumination
Surface	Backlighting of textiles, etc.	Interior light, glove compartment illumination
multiple	Switch illumination	Recessed handle illumination, Door surrounding illumination



**Different versions of fiber optic light guides**

## Switching concepts

As a matter of principle, switching concepts can be divided up into two categories: load switches and signal switches. Load switches are available in the form of knobs, slide switches, toggle or rocker switches and push buttons. Important features are the clearly perceivable switching function upon arresting and the installation size, which can be reduced to a certain minimum depending on the power. The operating states of a load switch are "ON" and "OFF". With signal buttons, the load current is controlled without contacts by an additional electronic circuit. Various signals can be used for actuation of this electronic circuit; in the most simple case a switching pulse from a button is sufficient. Signal buttons are miniaturized switches with or without "click". Switching mats, such as are used in other electronic products, are also being increasingly used. Electronic support also allows realization of other functions such as dimming (soft start/fade out).

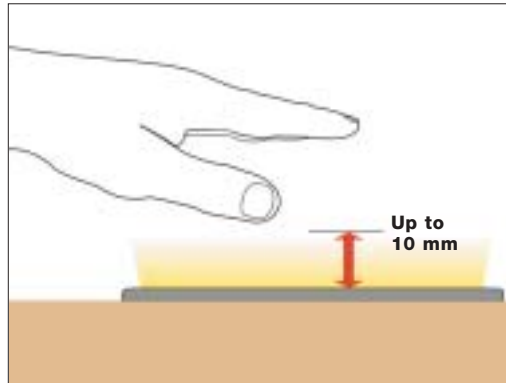


**Various load switches**



**Various signal switches**

Proximity type switching technology from Hella Interior Lighting Systems fulfills other, farther-reaching customer requirements. With this new technology, buttons can be replaced with proximity sensors. The electronic circuitry can be controlled without any mechanical switching components by simply moving close to the switch.



**Basic diagram of proximity type switching technology**

## Electronic circuitry

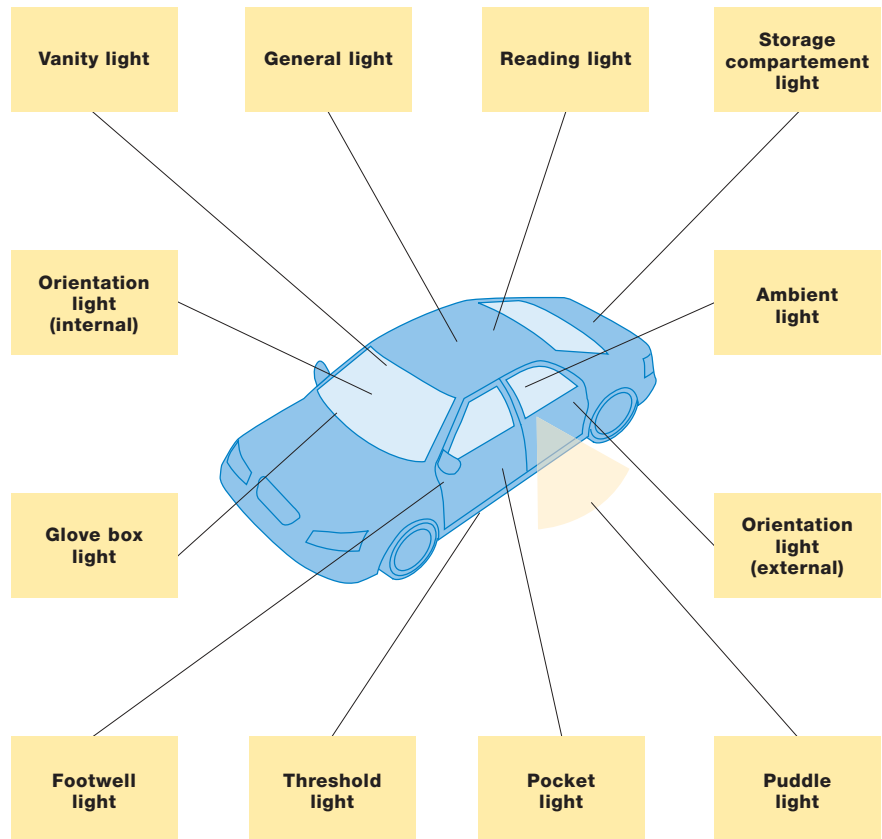
As the competency center for interior lighting, Hella Interior Lighting Systems also possess comprehensive know-how in the field of electronics required for the products. This know-how includes development and testing as well as installation of components on printed circuit boards. High-tech SMD engineering is available for equipping circuit boards. Close cooperation between the electronic development and production departments within the Hella group allows even highly complex requirements to be satisfied.

Our electronic competency focuses on the fields:

- CAN/LIN linkage
- Light source control, particularly for LEDs and EL foils
- Light management
- Proximity type, electronic switches
- Analog/digital electronic circuitry
- Inclusion of other electronic components

## Product spectrum

The products from Hella Interior Lighting Systems offer all imaginable solutions for vehicle passenger compartments and range from miniature lights to interior/reading lights, reaching all the way to complex modules integrating a large variety of features. The numerous innovative solutions lead to a continuous increase and renewal of the product spectrum.



Interior lighting possibilities

## Miniature lights

The function of miniature lights is defined by their size and location. As a rule our miniature lights can be used universally for applications such as the make-up mirrors, foot wells, boot, map compartment, vehicle doors, glove compartment, door handles, etc.



**Standard and miniature lights**

### Interior/Reading lights

Interior lights are flood lights and fulfill the requirements for illuminating the interior as brightly and shadow-free as possible. Reading lights emit a highly focused light in a direction defined by the customer. This high, constant illumination intensity ensures fatigue-free working and reading, without disturbing the driver.



**Interior light**



**Flat make-up mirror light**



**Interior reading lights**

**Modular systems**

Modular systems provide for integration of various features in one unit. Here light functions (interior light, reading light and ambient light), special electronic applications (garage door opener, passenger compartment monitoring for anti-theft alarm, switches, parking aid, etc.) and mechanical components (spectacles compartment, sun visors, etc.) are combined. Modular design allows these complex lights to be configured variably conforming to customer requirements.



**Modular overhead console**



**Overhead control units**

### Ambient lighting

Use of ambient lighting creates a private, relaxed atmosphere and can serve for orientation in the vehicle. This type of interior lighting allows you to travel comfortably and safely. The significance of ambient lighting will increase continuously in future vehicle concepts. Hella Interior Lighting Systems develops important concepts and sets standards for this function class.



**Hella innovation vehicle with white foot well**



**Hella innovation vehicle with blue foot well**



**Hella innovation vehicle with red foot well**



**Door mirror illumination**



**Overhead control module with light circle**



**Equipment with integrated ambient lighting**

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