

Technical Information

*Light – Reflection Swiveling System
for VARILIS®*



*Ideas today for
the cars of tomorrow*

Motivation for the development of reflection swiveling systems

In many headlamps, the following functions are already available in series as options from the VARILIS® **V**ariable **i**ntelligent **L**ight **S**ystem construction kit:

- Static bend lighting as an additional element of the low beam function
- Dynamic bend lighting as swiveling low and/or high beam (previously available from Hella as projection module in halogen, Bi-Halogen, Xenon, Bi-Xenon® variants)
- Cornering light (from a regulatory approval standpoint, a lighting function)

Dynamic bend lighting is a well visible lighting function with great benefit for the end-customer, because the entire headlamp light distribution is swiveled by up to $\pm 15^\circ$. This dynamic movement of the light distribution represents an active gain in safety due to the increased range of illumination along the road. On winding roads, visibility can therefore be increased by up to 50%, depending on the curve radius.

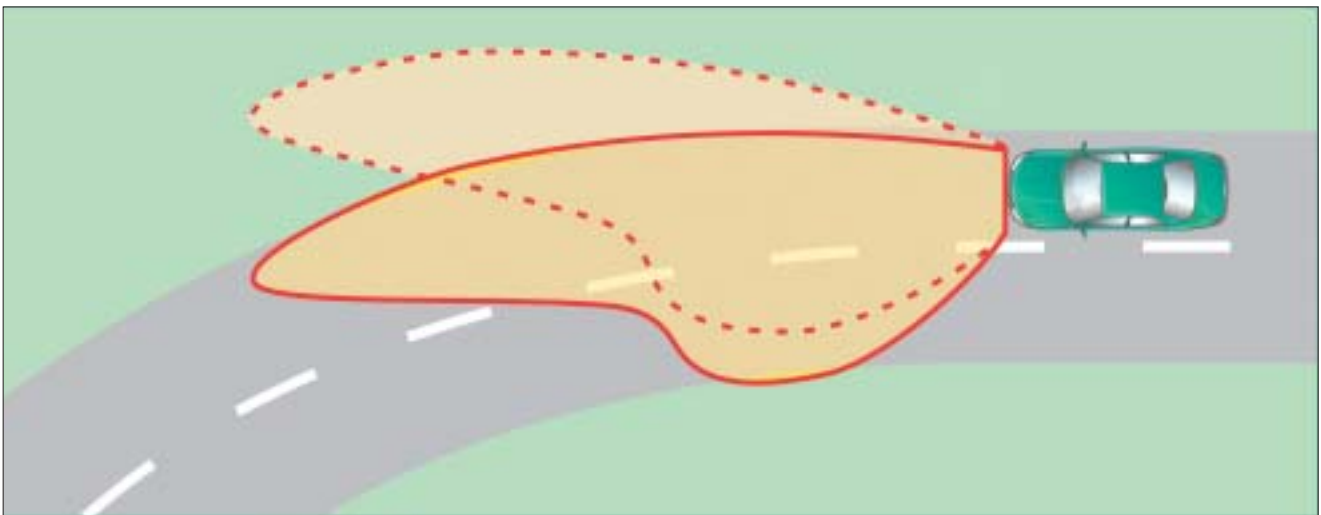


Fig. 1: Light distribution for bend lighting, schematic

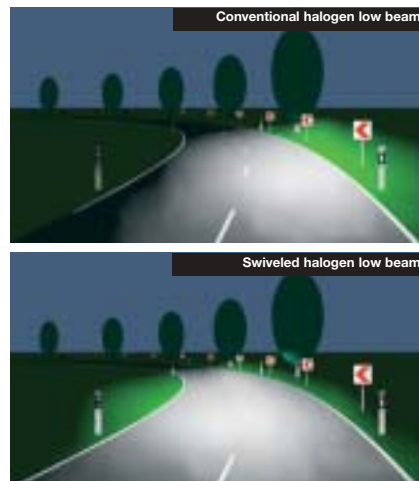


Fig. 2: Improved road illumination by swiveled low beam

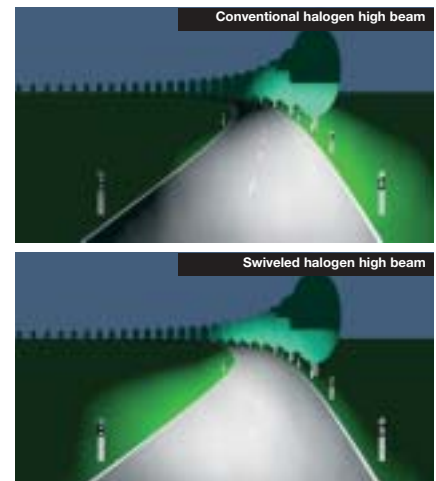


Fig. 3: Improved road illumination by swiveled high beam

To make these advantages available in compact and middle class vehicles as well, Hella expands its dynamic bend lighting product range by another option:

- Dynamic bend lighting on the basis of free-form reflection systems with halogen bulbs (as single- or double-chamber system)

The system combines the advantages of the dynamic bend lighting with the design freedom and technical possibilities of free-form reflection systems. The fundamental properties of free-form reflection technology can be used to adjust the luminous intensity distribution to the customer specifications, within legal bounds, for product differentiation. Project-specific styling requirements can also be accommodated within these boundaries.

Moreover, halogen reflection systems also offer a favorable price-benefit ratio in compact and middle class vehicles. The system structure enables a compact design for all swivel angles and in particular takes into account the current market requirements with regard to installation size. The swiveling concepts are of a modular design and can therefore be combined with various reflector sizes and geometries.

Reflector systems as solutions offer the possibility of equipping static headlamps with rigid reflectors at low cost as a basic version and to supplement them by a compatible optional swivel function, with almost identical reflectors used for both variants.

The product pair

- basic version: rigid halogen reflection system and
- option: halogen single swiveling system/halogen double swiveling system

therefore offer a tangible benefit for the customer while preserving the outer appearance of the headlamp.

As in the case of the projection modules, various designs of the reflection swiveling systems will be available which are geared toward the factors of costs, package space and performance:

- A single swiveling system to swivel the low beam with separate static high beam
- Alternatively, a single swiveling system for simultaneous swiveling of low and high beam by a reflector with an H4 bulb.
- Or a double swiveling system with just one drive, enabling the coupled swiveling of the low- and high-beam chambers.

Single swiveling system



Fig. 4: Sample of a swiveling single-chamber reflection system

This first variant is intended for single-chamber reflectors with single-filament bulbs (H1, H7) or double-filament bulbs (H4). A simple overall design is realized for low-cost implementation. The stepper motor for the swivel function is arranged horizontally in the lower area of the assembly and, via a coupling piece, acts directly on the reflector. The basis of the system is a headlamp-specific carrier frame which provides high flexibility of the arrangement of the basic adjusting elements and the actuator for headlamp leveling.

The structure of the swiveling reflection systems (**Fig. 4 and 5**) provides system advantages for pedestrian protection and for thermal and vibration properties. Due to the arrangement of the reflector's swivel axis near the reflector flange surface, the gap sizes necessary for operation can be minimized.

Double swiveling system



Fig. 5: Sample of a swiveling dual-chamber reflection system

For double reflectors, Hella provides the dual-chamber reflection system to offer the option of realizing a dynamic high beam in addition to the dynamic low beam — without an additional actuator. To this end, the high-beam reflector is swiveled with swivel angles especially optimized for the purpose, in addition to the low-beam reflector. The two reflectors are suspended in a headlamp-specific carrier frame and are rotatable on bearings. The reflectors are coupled via a joint and the low-beam reflector is directly linked with the swivel drive. **Fig. 5** shows an embodiment of the concept of the dual-chamber reflection system.

This kinematic design enables different swivel angles for low and high beam, which meet the technical lighting requirements, because due to their different ranges, the high beam requires smaller swivel angles compared to the low beam. Accordingly, the maximal swivel angles are also different. The swivel angle of the low beam in this example is 12° and that of the high beam 7.5°. Of course, other ranges can be realized depending on application.

The free-form reflectors of the system can be equipped with the usual halogen bulbs. For example, the following combinations are possible:

- Low beam H7, high beam H1
- Low beam H7, high beam H7
- Other bulbs can be used depending on the project.

Electronics concept

With the electronics concept, Hella strives for an application for the respective vehicle electric system architectures which is as simple as possible. A central AFS control unit is used as a standard component to control the dynamic bend lighting based on reflection systems. The control unit receives signal data available on the CAN bus, such as vehicle speed and steering angle, which characterize the current driving situation. These data are processed in the control unit and converted into control signals by means of intelligent algorithms. The control signals are transmitted, via a LIN bus for example, to the intelligent stepper motors (ISM) installed in both headlamps to swivel the lighting module in accordance with the road course. An additional halogen light source for static bend lighting can be controlled via a PWM signal. To compensate for different states of load of the vehicle, the AFS control unit can also control the headlamp leveling actuators in the headlamps.

Adjustable customer-specific parameters include swivel speed and swivel strategy. An option in the development of such a system is the realization of different swivel angles for the reflectors which are at the inner or outer radius of a curve, respectively. An example of a common swivel strategy, which is based on our experience with the development of projection swiveling modules, is the swiveling of the “outer” headlamp with the $a/2$ swivel angle and of the “inner” headlamp with the swivel angle a (also see examples in **Fig. 2 and 3**).

Summary

The reflection swiveling system available from 2007/2008 with its advantages offers a wider choice within Hella's VARILIS® **V**ariable **I**ntelligent **L**ight **S**ystem range.

Based on our experience as a supplier of dynamic bend lighting systems in the market, we are expanding our product range and therefore offer vehicle manufacturers the opportunity to apply the headlamp swiveling systems in a wider field of design and market segments.

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