



# PRODUCT INFORMATION

## HEADLIGHT LEVELLING ACTUATOR

- A market leader (appr. 70% Market share in India)
- Cost optimized product vs. other available solutions on the market
- Well-proven design and development competencies
- Supports adaptation to any set of country or regional specific requirements

### PRODUCT FEATURES

HELLA's electro-mechanical Headlamp Levelling Actuator is integrated in or attached to the headlamp to adjust the angle of the light beam according to the vehicle load conditions on the road surface. It is used for manual, as well as for automatic headlamp levelling systems.

This intelligent actuator operates with a manual switch or an electronic control unit to provide a controlled linear moment for a required position of the headlamp projector in order to ensure a comfortable light distribution for the driver. Our Headlamp Levelling Actuator is a flexible solution with customized fitment for various headlamps and with specific customer delivery position.

The load condition and pitching motion of the vehicle change the illumination range of the headlamps. This may dazzle other road users. This is why headlamp levelling systems (HLS) are legally prescribed. On this page, find out how standard market systems work, and how you can check them with simple means. Here, you can also learn what to do in the event of malfunction, and what you should note when adjusting headlamps with an automatic HLS.

#### Advantages

- Light-weighted and compact in size
- Smart technology, as it can operate manually or static-automatically
- Technical superiority vs. other solutions in terms of speed and durability

#### Function:

##### Manual headlamp levelling systems

A headlamp levelling system adjusts the height of the cut-off line to the load condition of the vehicle. This is supposed to avoid blinding oncoming traffic when the vehicle is loaded. Manual and automatic headlamp levelling systems are installed in current vehicle models. With manual systems, drivers have to adjust the inclination of the headlamp themselves by means of a switch. There are pneumatically and electrically operated systems.

The problem with this is that many loaded vehicles dazzle oncoming traffic since drivers are not well informed enough about the adjustment possibilities and their function on their vehicle.

##### Advantages

- Scalable concept for electronic control units with multiple channels, depending on the lighting functions
- The modular architecture allows the implementation of customer specific/ owned algorithms
- Reduced installation space, interfaces, connectors and simple assembly
- Flexible channel configuration for different light functions

##### Automatic headlamp levelling systems

These headlamp levelling systems fulfil their task without driver activity. We differentiate between two systems: Semi-static and dynamic headlamp levelling.

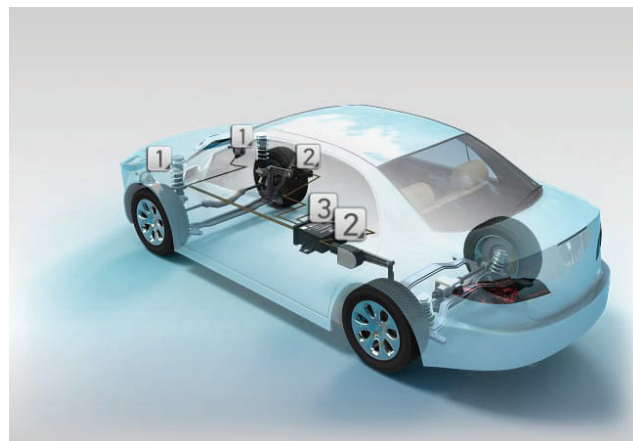
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## Semi-static headlamp levelling system

For the automatic headlamp levelling systems, we differentiate between two systems: Semi-static and dynamic headlamp levelling systems. The semi-static headlamp levelling system only corrects changes in headlamp inclination due to changes in load status.

A control unit evaluates the data from the front and rear axle sensors, compares this with the stored nominal data and triggers the actuator motors on the headlamps accordingly.

Usually the same type of actuator motors are used as for manual headlamp levelling systems. In the case of compact vehicles without long wheel overhang, this system offers the possibility of doing without the front axle sensor since the changes in inclination mainly occur on the rear axle only. In addition, semi-static headlamp levelling works with great damping, i.e. it only makes adjustments when the body is inclined for prolonged periods. In HELLA's xenon conversion sets an ultrasound system is used. Here, the sensor measures the direct distance to the road.



## Dynamic headlamp levelling systems

Today, almost all the vehicles fitted with xenon headlights are equipped with dynamic headlamp levelling systems which also react to driving-related changes in inclination, such as acceleration and braking.

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## Headlamp levelling actuator for manual and automatic headlamp levelling systems

In systems currently on the market, electrical headlamp levelling actuators have become prevalent, which by now are being built in the 3rd generation with additional improvements (version 3i).

HELLA offers optimal customer-specific system solutions. Headlamp levelling actuators for integration into headlamps, as well as externally mounted headlamp levelling actuators with or without basic manual settings are available in 12 V and 24 V versions. A fully automated manufacturing process with high quality standards guarantees an output of more than 10 million actuators a year. Due to a consistent increase in international production sites, we can also supply customers with actuators from Korea, India, and China.



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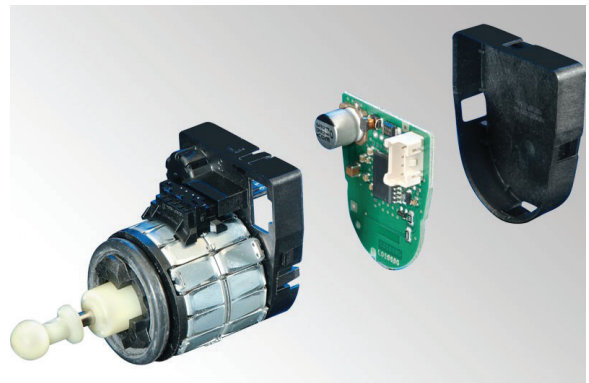
## ISM (Intelligent Stepper Motor)

The intelligent stepper motor combines the bipolar stepper motor with the power electronics, which are normally housed in a separate control unit, to form a mechatronic unit. The core component of the ISM is an integrated circuit that implements the complete stepper motor control, the diagnostics, and the interface with the higher-level system via a communications module with an integrated LIN-bus interface.

The main functional advantages of the intelligent stepper motor are:

- Micro step control (quiet and low-resonance operation)
- Diagnostic capability
- Improved EMC
- Partially autonomous error handling
- Optimised cabling concept

HELLA uses ISM technology particularly in variable headlamp systems. Besides the intelligent stepper motor for dynamic headlamp levelling, the dynamic bend lighting and the cylinder of the VARIOX® module are equipped with intelligent stepper motors.



## Control unit for automatic and dynamic headlamp levelling systems

Since 1995, HELLA control units for automatic and dynamic headlamp levelling systems have been used in vehicles with xenon lights.

The new generation of control units for headlamp levelling features an additional LIN-bus output and is therefore developing into a universal standard component. The deflection data of the axle sensors are processed in the control unit and are converted into control values for adjusting the illumination range by means of sophisticated algorithms. The modular design of the control units makes it possible to combine individual components, such as housing, connectors, printed circuit board, or software according to different customer requirements in order to achieve a maximum of cost synergy and flexibility. Thanks to the CAN-bus interface, it is possible to adapt the control unit to various vehicle types at the end of the vehicle production line by coding or programming the specific parameters.



## Inductive vehicle level sensor

For a number of vehicle systems that increase safety and comfort, such as an automatic suspension, level control, as well as automatic headlamp levelling, it is necessary to record the current tilt of the vehicle.

An inductive vehicle level sensor has several coils on the circuit board through which current flows and which generate an electromagnetic field. This circuit board moves a metallic rotor connected with the operating lever of the sensor, which influences the electromagnetic field. Additional coils on the sensor circuit board register a change in the field depending on the lever position of the sensor, which is analyzed by an ASIC specially developed for this purpose.

With this sensor, different angle areas can be realised with consistently high linearity. The inductive axle sensor provides both an analog and a PWM signal. The sensor works with outstanding precision and is completely independent of the temperature. The null position of the sensor can be individually varied. A further development of this sensor is the new inductive sensor, which provides a repeating PWM signal compressed to 75%. Therefore, the sensor can be used across platforms as a shared component. Different installation positions and mounting tolerances are compensated by electronic adjustments in the analysing control unit.

The next developmental goals are the optimisation of the installation space and the improvement of the output signal for chassis applications (vehicle level sensor of the 2nd generation).



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## Sensor-integrated headlamp levelling control unit

In a further development step for the automatic headlamp levelling in compact vehicles, the separate control unit was integrated into the axle sensor: Sensor Integrated Electronic Control Unit (SIECU).

The basis for the sensor-integrated headlamp levelling control unit is the inductive vehicle level sensor. The mechanical interfaces, such as the attachment and the sensor lever, are identical with those of the axle sensors.

As a sensor-integrated control unit on the rear axle, this solution for the automated headlamp levelling is not only suitable for vehicles with xenon headlights due to its advantages, but also provides additional comfort and safety in vehicles with halogen headlamps when used as a replacement for the manual headlamp levelling.



## Tips for dealing with headlamp levelling systems

If there is an electrical fault in the headlamp levelling system during driving, the headlamps remain in this position. In other vehicles, though, the headlamps are moved to the home position and stay there. The driver is always alerted about the error by a signal light or a text message in the cockpit.

### Defective headlamp levelling system

- Actuator motors on the headlamps are faulty
- Headlamp levelling system sensor for vehicle level is faulty
- Control unit has been replaced and not coded
- Headlamps have not been adjusted (basic setting)
- Control unit faulty
- Interrupted data cable
- No supply voltage
- Mechanical damage

## Checking headlamp levelling systems

- To adjust the headlamps a diagnostics tester is generally required for an automatic HLS. This can also be used to carry out diagnostics on the headlamp levelling system.
- The headlamp levelling system can be inspected without a diagnostics tester, however, with the aid of a multimeter and oscilloscope. It is important, however, to always make sure that a circuit diagram of the system to be tested is available.

Discover the **HELLA Electronic range** by following the link above. This comprehensive portfolio offers advanced automotive electronics for all stages of vehicle electrification, from intelligent battery sensors for micro-hybrids to high-voltage battery management systems for fully electric vehicles. Our selection includes various sensors (brake, climate, rain/light, and transmission range), actuators, power electronics (DC/DC converters and onboard chargers), control units, vacuum pumps, radar systems, and smart vehicle access solutions. HELLA is committed to providing innovative and reliable electronic components that enhance the performance, safety, and efficiency of modern vehicles.

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Product features, specifications and availability are subject to change without notice.

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