Xenon Headlights

Overview

The automotive industry/press often identify xenon lighting systems as HID (high intensity discharge) systems. Xenon headlight technology was first introduced to the US market exclusively on the E32 750iL in 1993. BMW xenon headlight systems have evolved and their availability as optional equipment has spread throughout the model lineup.

Blue/White in color and using ellipsoidal technology Xenon headlights provide improved night time visibility in all driving conditions compared with traditional Halogen bulb headlights.

Benefits:

Xenon headlights provide the following benefits:

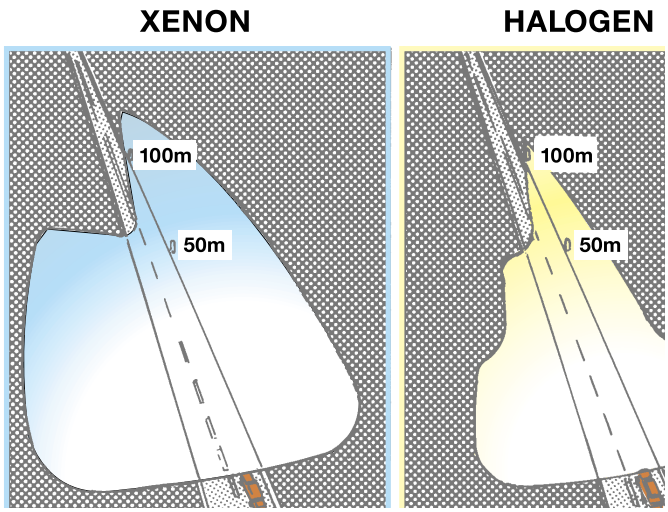
- **Longer bulb life**. Typically, xenon bulbs will last from 3 to 5 times longer than halogen.
- **More light output.** Xenon headlights produce from 2.5 to 3 times more lumens than halogen.
- **Blue/White light** *(simulates natural daylight)*. Xenon bulbs produce a blue/white light while halogen bulbs produce a yellow light. The light color of a light source is measured in color temperature (not to be confused with thermal temperature). Color temperature is measured in Kelvins (K). The higher the color temperature the whiter the light.

  Natural daylight = 4,500 to 5,000 K
  Xenon headlights = 4,000 to 4,500 K
  Halogen headlights = 3,200 K (yellow in color)

- **Better driving visibility.** The combination of higher lumens and higher color temperature provide a superior lighting source.

  The beam is wider and brighter in front of the vehicle than conventional halogen bulbs improving safety and driver comfort.

- **Lower operating temperature.**
- **Lower power consumption.**



Version Identification & System Summaries

Version identification is specific to vehicle model with the exception of the E38.

There are two E38 Xenon systems. The early system identified as **Generation 2.1** and equipped on 95-98 model year 750iL vehicles. The headlight design of this version has a flat bottom edge.

The **Generation 3** system was introduced on 1999 model year E38 vehicles. This system can be visually identified by the rounded bottom edge.

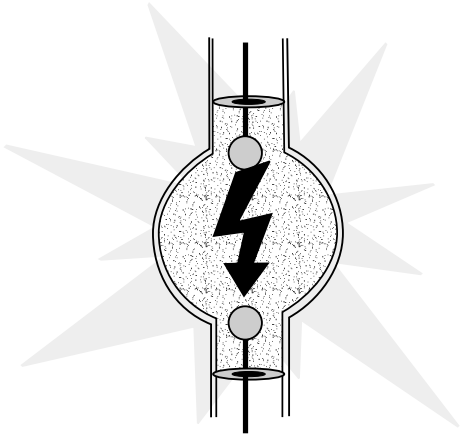
LWR: All Xenon systems from M.Y. 99 are also equipped with LWR (Headlight Beam Throw Control). This system automatically adjusts the vertical position of the headlight beams to compensate for vehicle loads ensuring optimum beam throw. LWR components and function is described further on in this section.

Headlight Replacement Parts: In previous model years, individual replacement parts were not available for headlight assemblies. This was due to the Federal Motor Vehicle Safety Standards (FMVSS) relating to pitting or corrosion of the reflector components in non-sealed beam light assemblies.

BMW has recently submitted corrosion test data for headlight replacement components which have passed the FMVSS providing availability of headlight assembly spare parts. The approval has been given for **all Bosch** headlight assemblies (including halogen systems).

Vehicle/ Model	Model Year	Manufacturer(s)/ Version ID	LWR- Head Light Beam Throw Cont.	Individual Replacement Parts Available
E32/ 750iL	93-94	**Hella** (Light & CM "control module") Generation 1	No	No
E38/ 750iL	95-98	**Bosch** (Light & CM) Generation 2.1	No	Yes
E38/ All	99-01	**Bosch** (light) **Hella** (CM) Generation 3	Yes	Yes
E39 All	99-	**Hella** Generation 3	Yes	No
E46	99-	**Bosch (Light & CM)**	Yes	Yes

Xenon High Intensity Discharge Bulbs



Xenon bulbs are identified as D-2S (D=Discharge). Xenon bulbs illuminate when an arc of electrical current is established between two electrodes in the bulb.

The xenon gas sealed in the bulb reacts to the electrical excitation and heat generated by the current flow. The distinct bluish/white brilliant light is the result of the xenon gas reacting to the controlled current flow.

Phases of Bulb Operation:

Starting Phase: The bulb requires an initial high voltage starting pulse of 18-25kV to establish the arc.

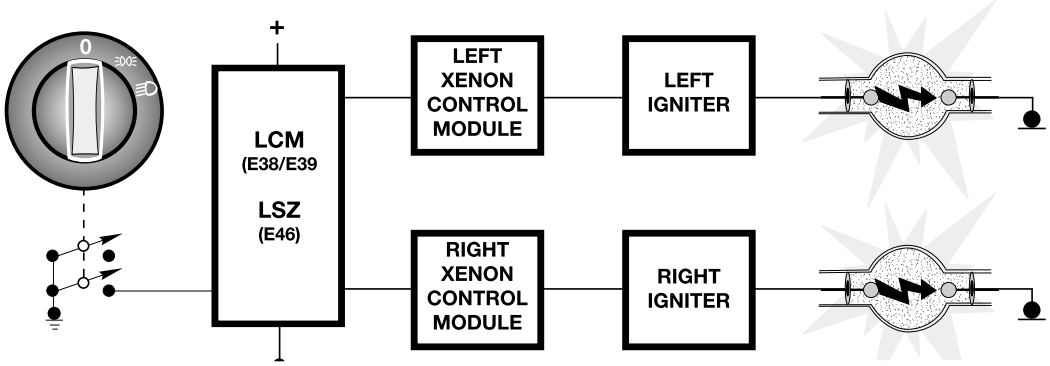
Warm Up Phase: Once the arc is established the power supply to the bulb is regulated to 2.6A generating a lamp output of 75 watts. This is the period of operation where the xenon gas begins to brightly illuminate. The warm up phase stabilizes the environment in the bulb ensuring continual current flow across the electrodes.

Continuous Phase: Once the warm up phase is completed, the system switches to a continuous mode of operation. The supply voltage for the bulb is reduced and the operating power required for continual bulb illumination is reduced to 35 watts which is less than a conventional halogen bulb.

Functional Description

To regulate the power supply to the bulbs, additional components are required. The xenon control modules (1 per light) receive operating power from the lighting control module (LCM E38/E39/E53) when the headlights are switched on. The xenon control modules provide the regulated power supply to illuminate the bulbs through their phases of operation.

The igniters establish the electric arcs. Integral coils generate the initial high voltage starting pulses from the control module provided starting voltage. Thereafter they provide a closed circuit for the regulated power output from the control modules.

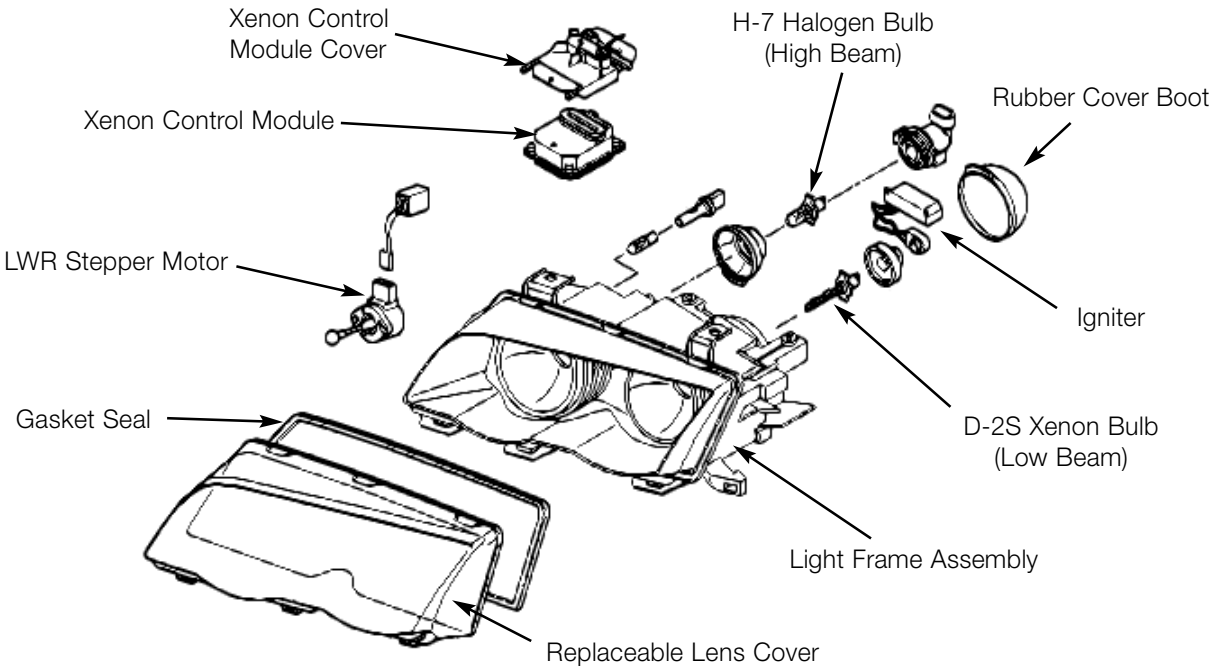


Xenon Bulb Monitoring

Xenon bulb function is monitored by the Lighting Control Module (LCM E38/E39/E53). The bulbs are only “hot” monitored. Cold monitoring is not possible since the lighting control module is not in direct control of the xenon bulb. For this reason cold monitoring for low beam headlights is encoded off in the lighting control module for Xenon headlight equipped vehicle.

The lighting control module detects xenon bulb failure via a reduction in current flow to the xenon control module. When a bulb fails, the xenon control module’s current consumption drops to 60mA indicating unsuccessful xenon bulb illumination. The lighting control module then posts the appropriate matrix display message or LED illumination in the Check Control Pictogram display of the E53 and E39 Low Instrument Clusters.

Xenon Headlight Assembly Components (Example - E53)



Xenon Headlight Testing

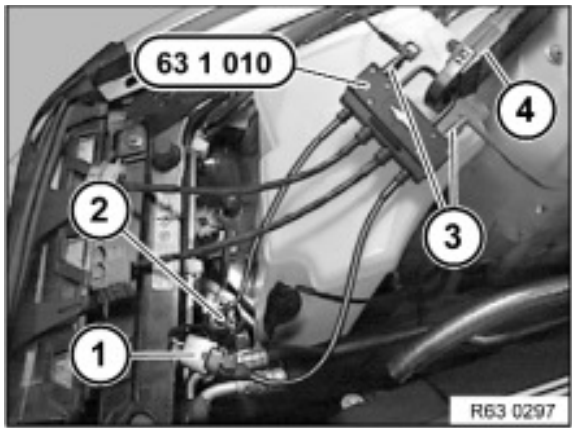
Warning: *Xenon headlight control systems generate high output voltage. Prior to headlight removal or testing observe the vehicle warning labels and be cautious by following safeguards to prevent accidental injury.*

Xenon headlight systems (control module, igniter and bulb) produced prior to 9/98 can be tested with Special Test Adapter (P/N 90 88 6 631 000) in conjunction with the **DIS** Pre-set Measurements System.

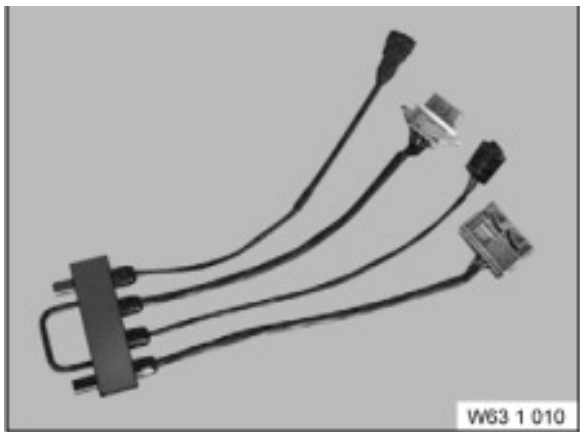
The DIS Measuring System includes all of the cable connection information and procedures for the test.

Generation III Xenon lights on vehicles produced after 9/98 are tested with a different tool. Xenon test adaptor P/N 90 88 6 631 010 is used along with DIS/MoDiC pre-set measurements “Xenon lights after 9/1998”.

The Generation III test adaptor uses the 50 amp test cable with both the MoDiC or DISplus.



1&2 Adaptor connected in series with headlight harness.
3 MFK 1 Pos. and Neg. input leads.
4 50 Amp clip on probe.



Xenon Generation III Test Light Cable (90 88 6 631 010)

In addition to the Measurement System tests there are also Test Modules available in the Diagnosis Program to diagnose vehicles with Generation 3 Xenon lights.

LWR - Headlight Beam Throw Control

Overview

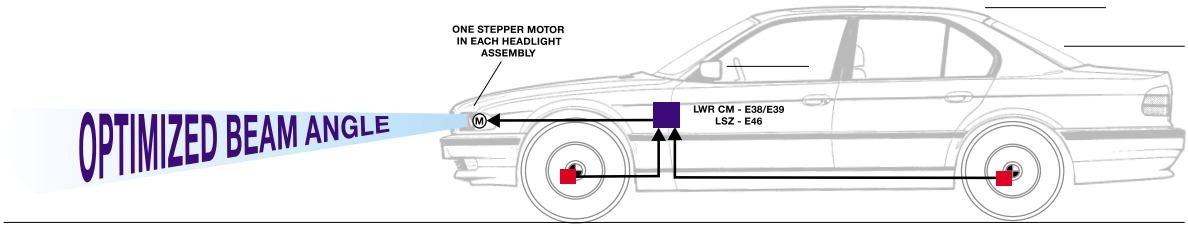
LWR automatically adjusts the vertical positioning of the headlights to maintain optimum headlight beam positioning for maximum driving visibility and to prevent undue glare for oncoming motorists. The system compensates for vehicle load angle changes (ie: diminishing reserve of gasoline in fuel tank during a long journey, overloaded cargo weight, etc.)

LWR has been available on BMW vehicles in other markets for quite some time. Starting with the 1999 model year all US market vehicles with Xenon Lights incorporated LWR as standard equipment. LWR is not available with standard halogen headlights.

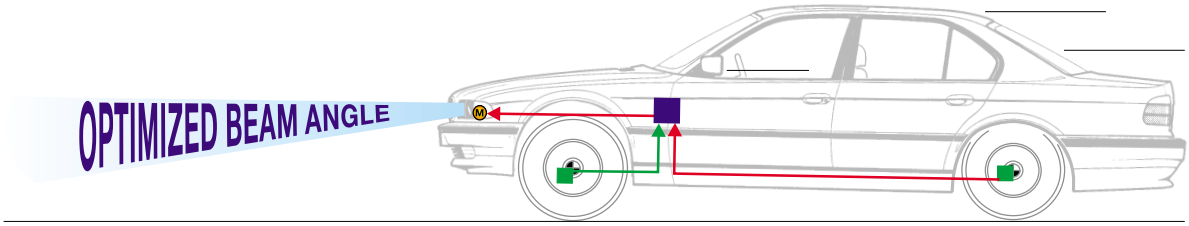
LWR monitors the vehicle's loaded angle via two hall effect sensors mounted to the front and rear suspension members. When an adjustment is necessary, LWR simultaneously activates two stepper motors (one in each headlight assembly).

The stepper motors drive a threaded rod that moves the lower edge of the headlight carrier plate forward and backward (depending on driven direction). The upper edge of the headlight carrier plate is fixed on a pivot. The pivoting movement adjusts the vertical position of the headlight beam.

NORMALLY LOADED VEHICLE



OVERLOADED VEHICLE (EXAGGERATED)

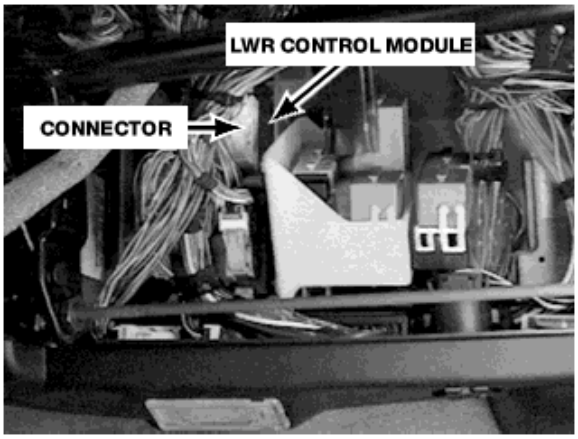


LWR Components

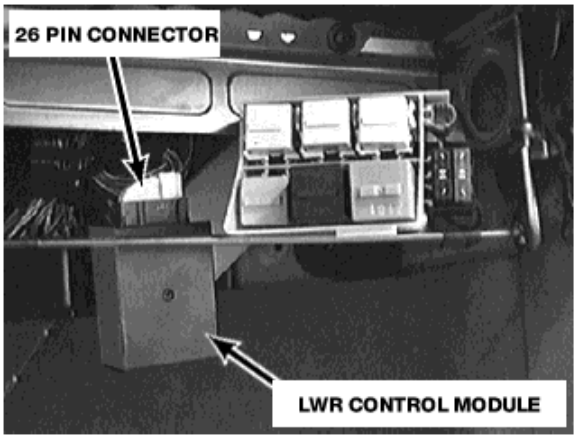
Control Electronics

LWR Control Module - E38 & E39 Vehicles:

The LWR control module is located in the electronics carrier forward of the glovebox. The control module connects to a single, 26 pin, yellow harness connector. The control module has diagnostic capabilities and communicates with the DIS/MoDiC via the K bus - IKE gateway to the D bus.



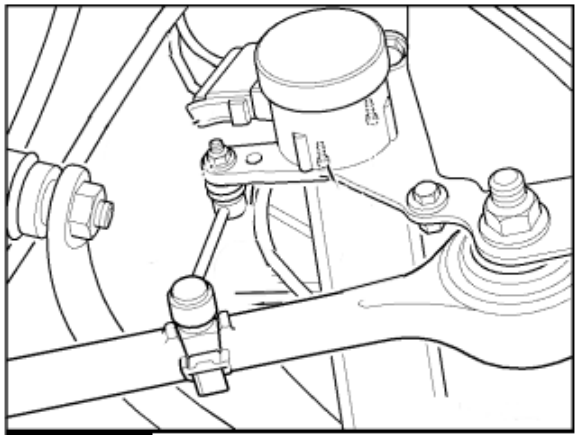
E38 LWR Control Module Location Location



E39/E53 LWR Control Module

Level Sensors

LWR monitors two hall effect level sensors to determine vehicle load angle. The sensors are mounted to a fixed point on the suspension carriers of the front and rear axles.



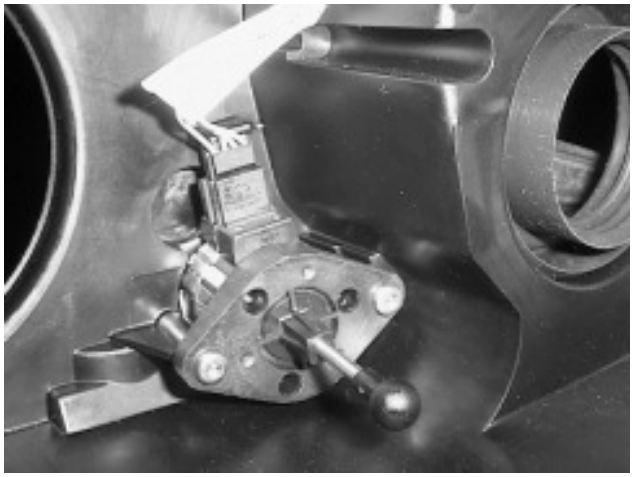
A lever is connected to the moving suspension member which changes the sensors output linear voltage signal as the suspension moves up and down.

Note: E39 sport wagon vehicles with EHC have a dual output sensor at the right rear location. This sensor shares the same housing as the EHC systems right rear level sensor.

Headlight Adjustment Stepper Motors

One stepper motor is located inside each headlight assembly.

The 4 wire stepper motors are controlled by the LWR control electronics to change the vertical headlight position.



Functional Description

The E38/E39 system comes on-line when the lights are switched on.

The LWR control electronics then cycles the stepper motors through their full range of motion and stops at a default position.

The control electronics monitors the level sensor input signals to determine the vehicles load angle and adjusts the beam position accordingly. As the vehicle is driven it continually monitors the level sensor signals and if necessary updates the headlight beam positions every 25 seconds on the E46 or momentarily on the E38/E39 system.

Abrupt fluctuations of the sensor signals are filtered to prevent unnecessary adjustment as well as monitoring road speed and brake pedal application as correction factors.

HEADLIGHT ALIGNMENT

The procedure for aligning Xenon Headlights with LWR is the same as conventional halogen bulb systems with one additional step. Wait at least 30 seconds for the LWR to cycle and adjust to it's calculated position.

LWR DIAGNOSIS

The LWR control module of the E38/E39 is diagnosible using the DIS/MoDiC. The headlights must be switched on in order to start diagnosis.

The E46 LSZ incorporates LWR diagnosis program.