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E46 DRIVER INFORMATION

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Introduction

The driver information system is presented to the driver in two main areas, the instrument cluster and the center console area. The E46 makes extensive use of bussing for communication between control modules and reduction in wiring.

The instrument cluster in the E46 is similar in design to the basic cluster installed in the E39. It uses the pictogram display block for check control and lamp failure warnings.

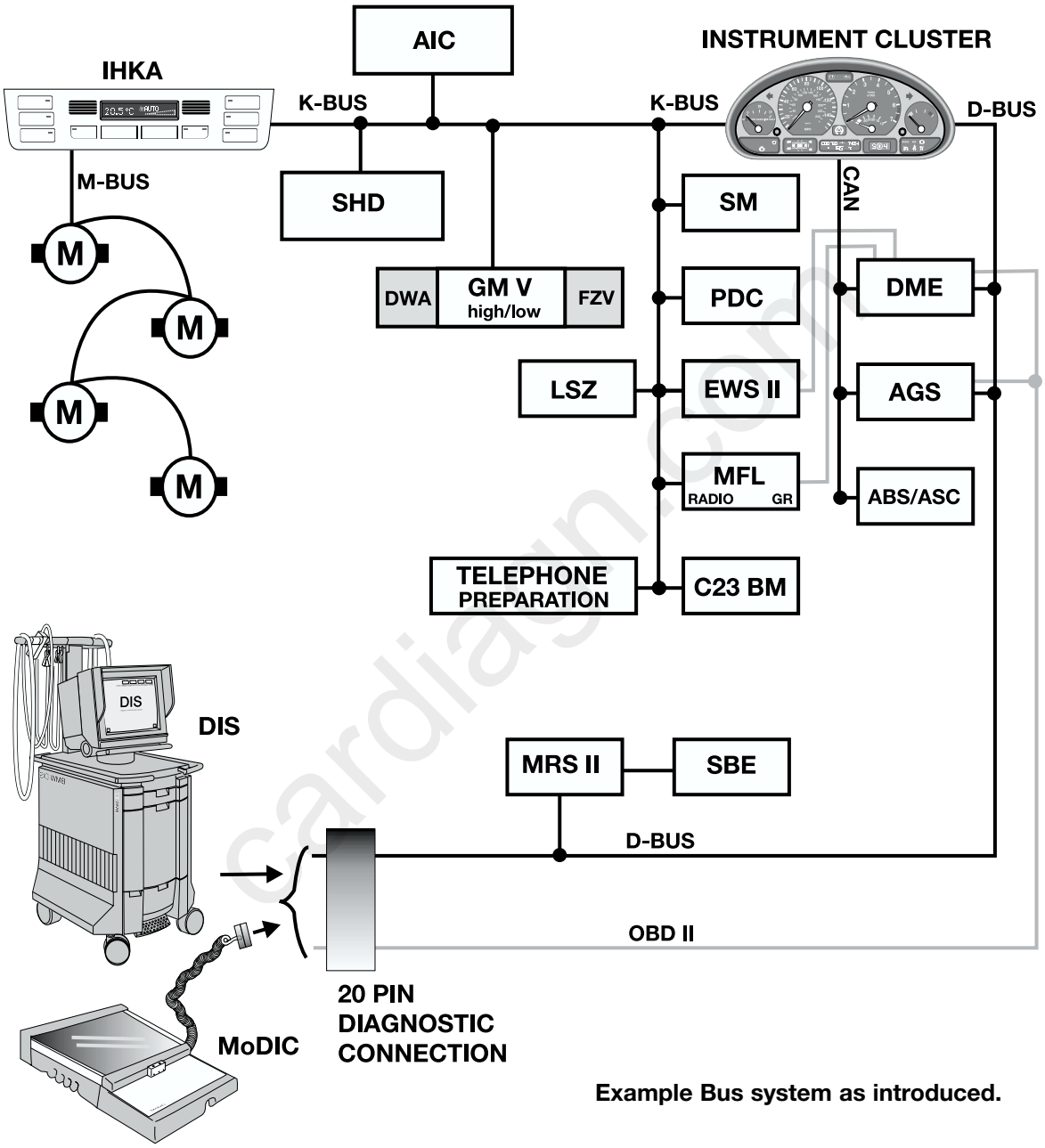
The Bus links used in the E46 include:

The K-Bus: For communication between all body modules and driver information systems.

The CAN Bus: For communication between the engine management control modules and the instrument cluster.

The D-Bus: For diagnostic communication between the vehicle and the DIS and MoDiC testers.

E46 BUS SYSTEMS
BUS SCHEMATIC



Example Bus system as introduced.

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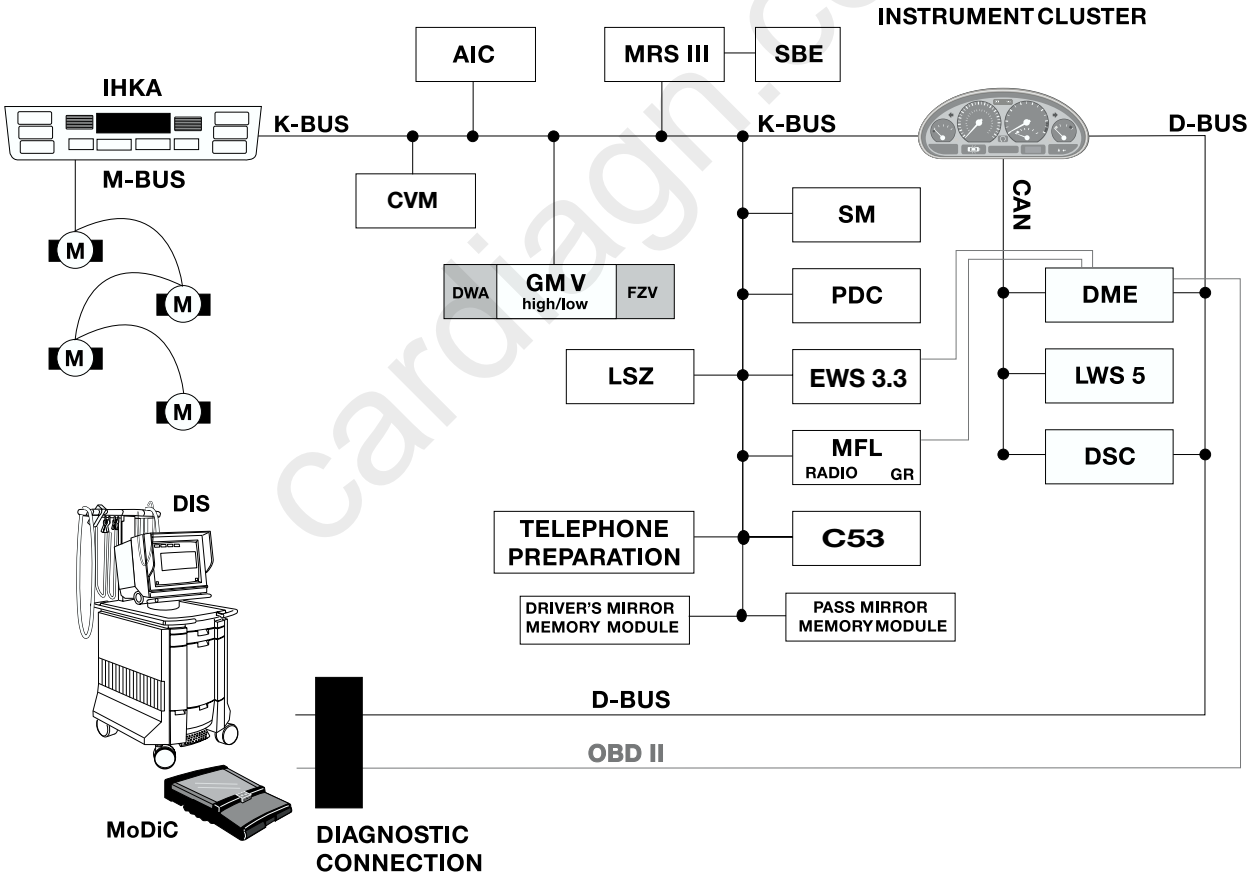
E46iC BUS SYSTEM

The Bus system of the E46iC continues to use the K-Bus as the main communication link between body and driver information modules. The Convertible Top Module (CVM) is added to the K-Bus for communication with the GM V for top operation and the Instrument Cluster for diagnostic purposes. The addition of memory functions for both outside mirrors has required memory modules to control the operation. These modules are also connected to the K-Bus for communication with the Seat Memory module.

As with other MRS III systems, the MRS module is now connected to the K-Bus for coding/diagnostic and communication with the other control modules.



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SIGNALS WHICH ARRIVE AT THE INSTRUMENT CLUSTER VIA THE K-BUS

INFORMATION ITEM	SOURCE	RECIPIENT
doors, trunk lid	basic module	instruments
driving light error	light-switch center	instruments
brake light error	light-switch center	instruments
turn signal control	light-switch center	instruments
turn signal synchronization	light-switch center	instruments
position light, dipped beam, high beam, fog light	light-switch center	instruments
rear light error	light-switch center	instruments
ignition key	electronic immobilizer	instruments
DME-S-AC, air condit. Switch	IHKR	instruments
DME-LSZ-KK, load torque air conditioning	IHKR	instruments
transfer, km reading	light-switch center	instruments
reset BC function	on-board monitor/navigation computer	instruments
distance display,SA 9/98	on-board monitor/navigation computer	instruments

SIGNALS WHICH ARRIVE AT THE INSTRUMENT CLUSTER THROUGH THE CAN-BUS

INFORMATION ITEM	SOURCE	RECIPIENT
engine speed	DME/DDE	instruments
fuel consumption	DME/DDE	instruments
coolant temperature	DME/DDE	instruments
outdoor temperature	instruments	IHKA
selector lever position	AGS	instruments
gear program	AGS	instruments
transmission malfunction display	AGS	instruments
ASC indicator lamp	ASC	instruments
Check-Engine	DME/DDE	instruments
FGR indicator lamp - cruise	DME/DDE	instruments
EBV indicator lamp	ASC	instruments
fuel tank level	instruments	DME
VIN	instruments	LWS

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INSTRUMENT CLUSTER

The instrument cluster uses analog gauges for display of engine and road speed, engine temperature, fuel level and economy display.

There are three LCD blocks for display of:

- The check control - pictogram
- The BC/Service interval and mileage
- The Transmission - range/program and failure display

Warning indicators and lamps are arranged to the right and left of the LCD blocks. The ASC, charge indicator, high beam and oil pressure lamps are located between the speedometer and tachometer.

Features of the E46 cluster include:

- Stepper motor drives for the analog gauges
- New design Service Interval Indicator (SIA IV)
- Automatic transmission range/program display

The instrument cluster is a sealed unit and contains no serviceable components, other than the back lighting illumination bulbs.

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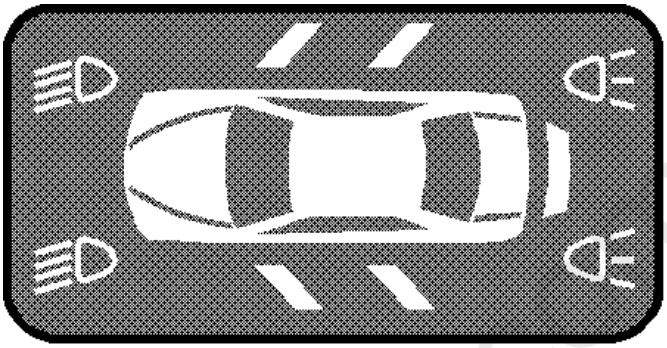
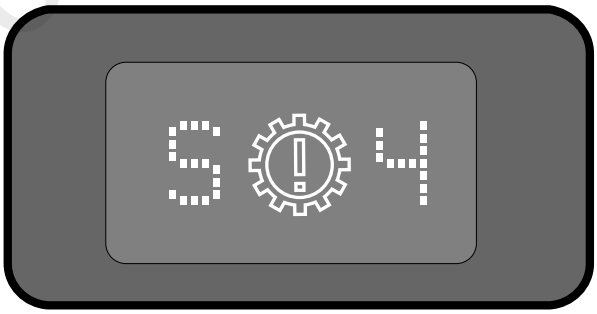
CHECK CONTROL LCD MATRIX DISPLAY

The pictogram check control display carries over from the E39 for failure display warnings of various lights, doors/trunk open and low fluid indications. Inputs for warning lamp indication are processed by the cluster electronics and the appropriate LED is illuminated.



RANGE/PROGRAM MATRIX DISPLAY

The right LCD matrix is used to display the driving range and program on vehicles equipped with an automatic transmission. The transmission fault display is also integrated into the display matrix. The gear with the explanation point will illuminate when the electronic control of the transmission detects a fault.



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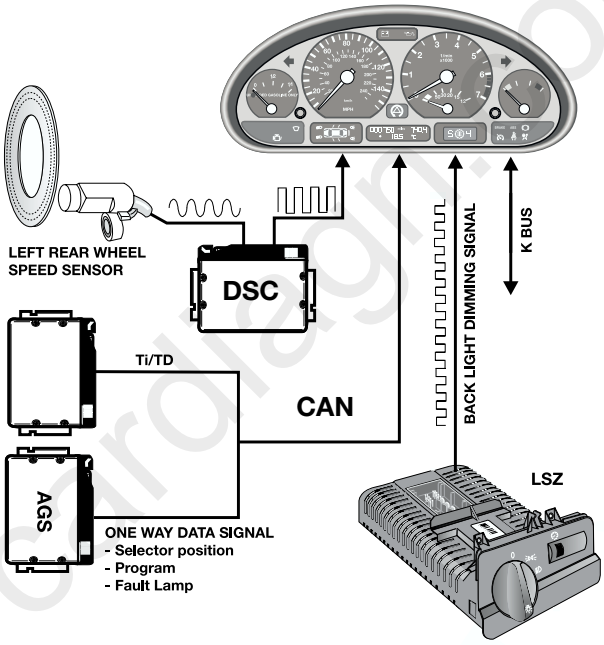
DYNAMIC DIGITAL INPUTS

DISTANCE SIGNAL- This input is supplied to the cluster by the ABS/ASC+T control module as a square wave signal. Pulses from the left rear wheel speed sensor are processed by the ABS module to produce this signal. The cluster electronics process the input for the cluster display and pass the signal along, on the K bus, as speed signal “A” for other control modules requiring the vehicle speed signal.

CAN BUS SIGNALS- The “Ti” , engine temperature and “TD” signals are produced by the DME control module and sent to the cluster. The cluster also passes the TD signal out over the K Bus.

TRANSMISSION DATA- The AGS control module provides the range selector position, driving program and fault lamp activation signals to the cluster over the CAN line.



OIL TEMPERATURE - This input is a pulse width modulated signal from the Electronic Oil Level Sensor. As oil level decreases the pulse width of the signal increases. If the signal shows an oil level that is too low over a period of time, the instrument cluster will illuminate the Oil Warning indicator LED in yellow.

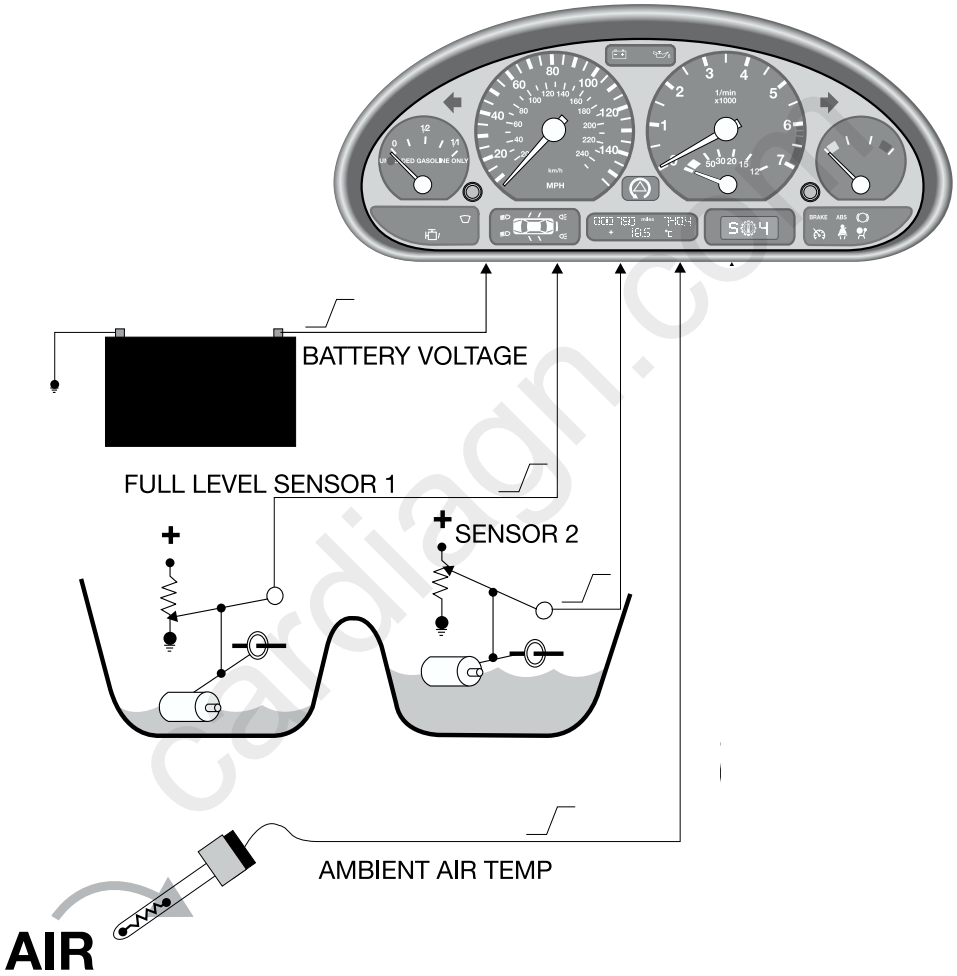
DIMMER SIGNAL - This is a pulse-width modulated signal from the LSZ. It is used to control the intensity of the back lighting of the instruments and the LCDs when the lights are switched ON. This signal is also output over the “K” Bus.

K-BUS SIGNALLING - The Cluster receives signals for the Check Control Pictogram over the K-Bus.

ANALOG INPUT SIGNALS

BATTERY VOLTAGE - Battery voltage is monitored by the cluster and a fault is stored if the voltage exceeds 16 volts

FUEL TANK LEVEL - Two lever action sensors are wired in parallel to the cluster. The two varying voltage signals are processed by the cluster for fuel gauge and low fuel warning display.



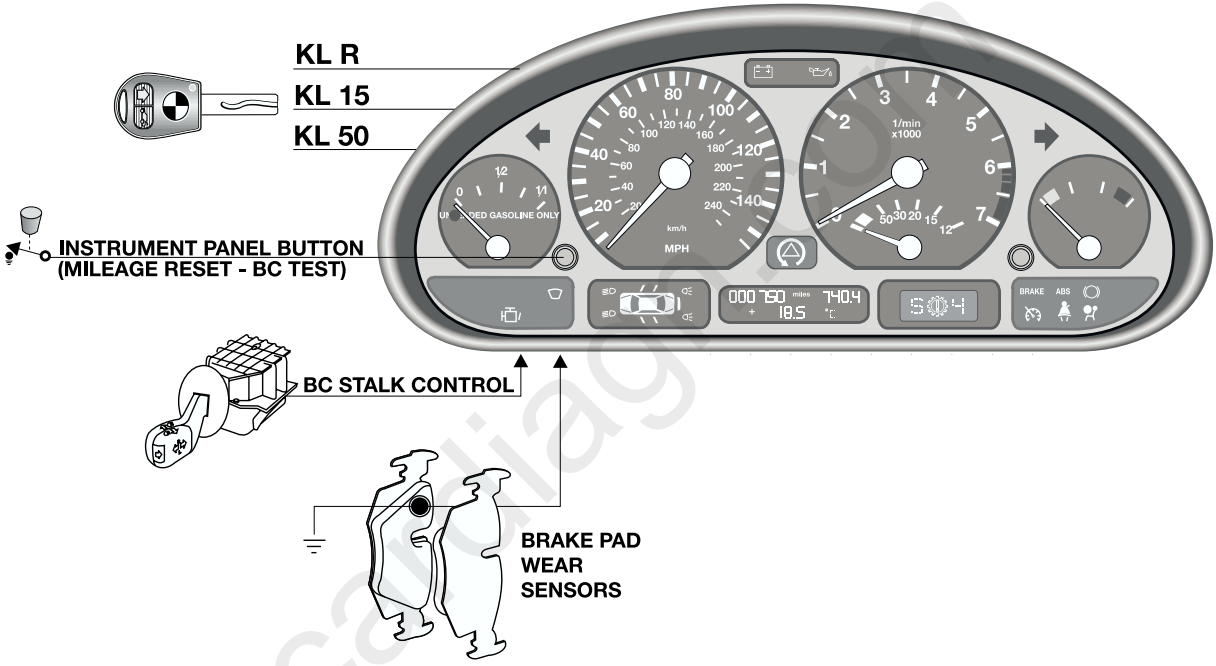
OUTSIDE TEMPERATURE SENSOR - A NTC sensor is used to measure the ambient temperature. The signal is processed by the cluster and passed out over the K Bus to modules requiring this input for processing.

DIGITAL INPUT SIGNALS

The normal ignition switch terminals (**KL R, KL 15 & KL 50**) are input to the cluster. Various functions are dependent on ignition switch position.

STEERING COLUMN SWITCH - As with previous systems the turn signal stalk is used to call up BC functions.

BRAKE PAD WEAR SENSORS - The pad sensor inputs are used to illuminate the brake pad warning indicator as in the past.



INSTRUMENT PANEL BUTTON - The reset button is used to reset the trip - odometer as in the past. It will also display the mileage, if pressed with the key switched OFF. This button is also used for the Base BC/instrument cluster test functions outlined on page 15.

INPUTS FOR WARNING LAMPS - Various switches are used to signal the cluster for warning and indicator lamp illumination including:

WARNINGS FOR CONVERTIBLES

- The seat belt warning lamp is illuminated when the seat belt is not fastened and FLASHES when the front seat back is not locked into position.

- The Roll over Protection System warning lamp is illuminated when there is a fault in the RPS system.

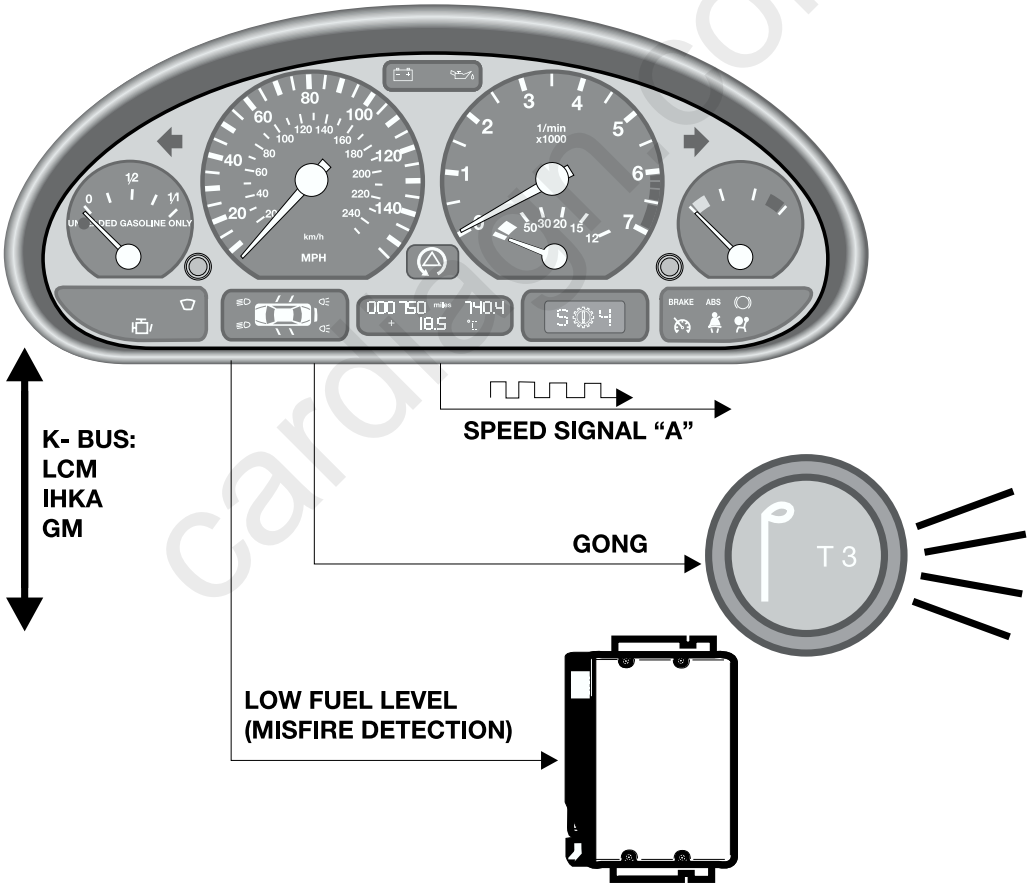
OUTPUT SIGNALS

SPEED SIGNAL "A" - The vehicle speed signal is available as an output for control modules that require precise vehicle speed information.

"K" BUS INTERFACE - The K Bus is used to transfer data between the cluster and other modules on the link. The diagnostic interface also passes over the K Bus for troubleshooting with the DIS Tester.

LOW FUEL - Based on the processing for the low fuel indicator lamp, this output is also sent to the DME control module. The signal is stored along with a mis-fire detection fault for troubleshooting purposes.

GONG OUTPUT - T3, The T3 tone is used for check control warnings.

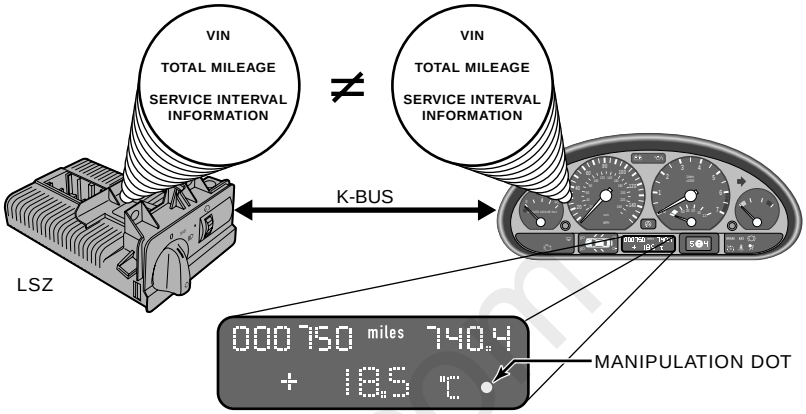


REDUNDANT DATA STORAGE

Specific information is stored redundantly in the instrument cluster and in the Light Switch Module. The data stored redundantly includes:

- VIN
- Total Mileage
- Service Interval data

The redundant storage of this information allows for the replacement of a module without the loss of the total mileage accumulated or the loss of the SI data.



The data is compared each time KL 15 is switched on. If the data does not match, the manipulation dot in the mileage display block will be illuminated.

The following points must be noted with regards to the redundant storage of this data.

1. If the vehicle ID number is not the same in both modules, the manipulation dot is illuminated. All functions of both modules continue to operate.

2. Data will only be transferred from the LSZ to the cluster if the ID numbers match and the cluster mileage is zero.

3. The VIN is entered in the cluster through coding and will only be accepted when the cluster mileage is zero.

4. The stored mileage in the LSZ can only be overwritten by a higher mileage.

5. If the two mileage values stored vary by more than 120, and the VINs are the same, the cluster will continue to accumulate mileage and a fault will be stored in the cluster for data transfer.

6. If the K-Bus link fails, the cluster will continue to store mileage and set a fault for the Bus link.

New components should only be installed for replacement purposes and not for use as test components for diagnosis as miles will accumulate if the vehicle is driven for road testing purposes.

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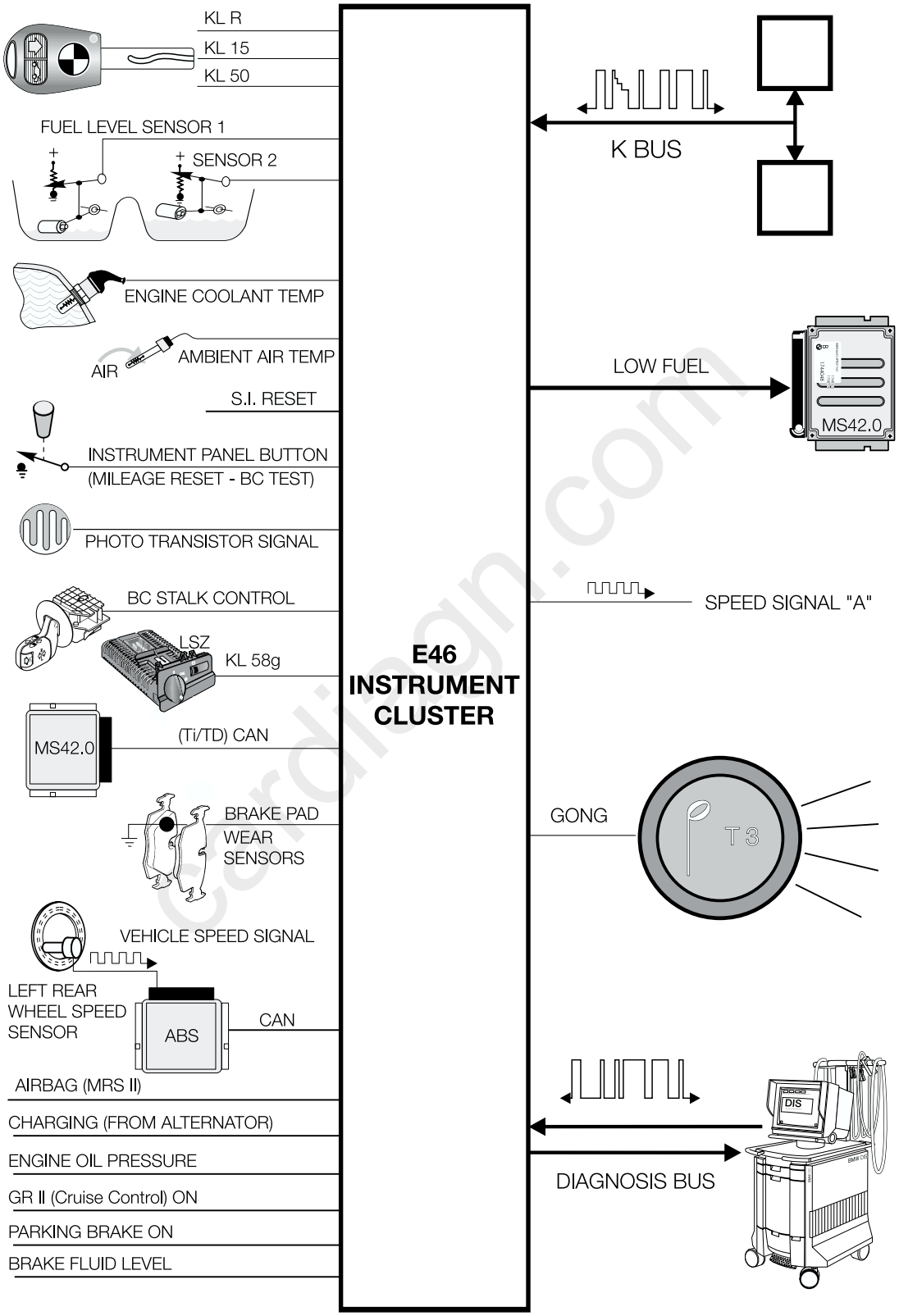

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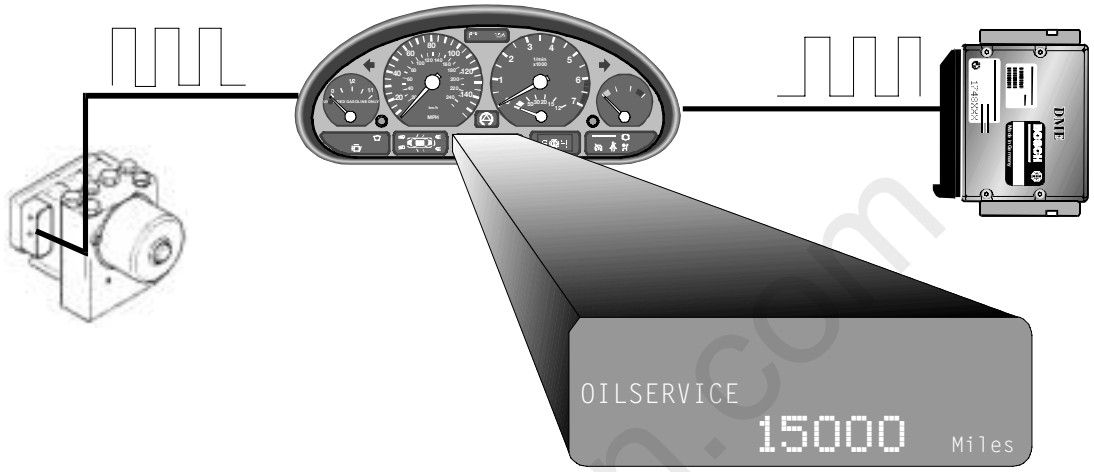
SIA IV

Models: E46

Production: From start of production



SIA IV Components:

- Instrument Cluster with LED display
- DME
- Vehicle Speed Signal

Instrument Cluster (IKE, KOMBI) with LED Display
The Instrument cluster calculates the Service Interval. The cluster is also responsible for displaying the mileage reading for the next service.

DME
The DME provides the Fuel Consumption (ti) signal.

ASC/DSC Control Module
The vehicle speed signal is provided by the ASC or DSC control module.

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Principle of Operation

Starting with the E46 a new method for displaying the Service Interval is used. Colored LEDs are no longer used to display the amount of time until the next service or inspection is due.

With the SIA IV system, the actual mileage remaining until the next service will be displayed for five seconds when the ignition is first switched on.

The text "OIL SERVICE" or "INSPECTION" will also illuminate to show which service is due. A minus symbol(-) before the mileage display indicates that a service is past due.

The calculation process for determining the service interval is similar to SIA III. A set volume is stored in the Cluster. The processor receives the ti signal from DME as the vehicle is driven. The Cluster also receives the vehicle speed signal from the ASC/DSC control module.

Based on the amount of fuel consumed and the distance traveled, the processor calculates the distance remaining to the next service.

Workshop Hints

Reset of the SIA can be done using special tool 62 1 110 if the vehicle is equipped with the 20 pin under-hood diagnosis connector.

On 2001 MY vehicles onward without the diagnostic connector in the engine compartment, the use of the S.I reset tool is not possible. The Service Indicator may be reset using the Reset Mode in the Instrument Cluster or with Diagnosis.

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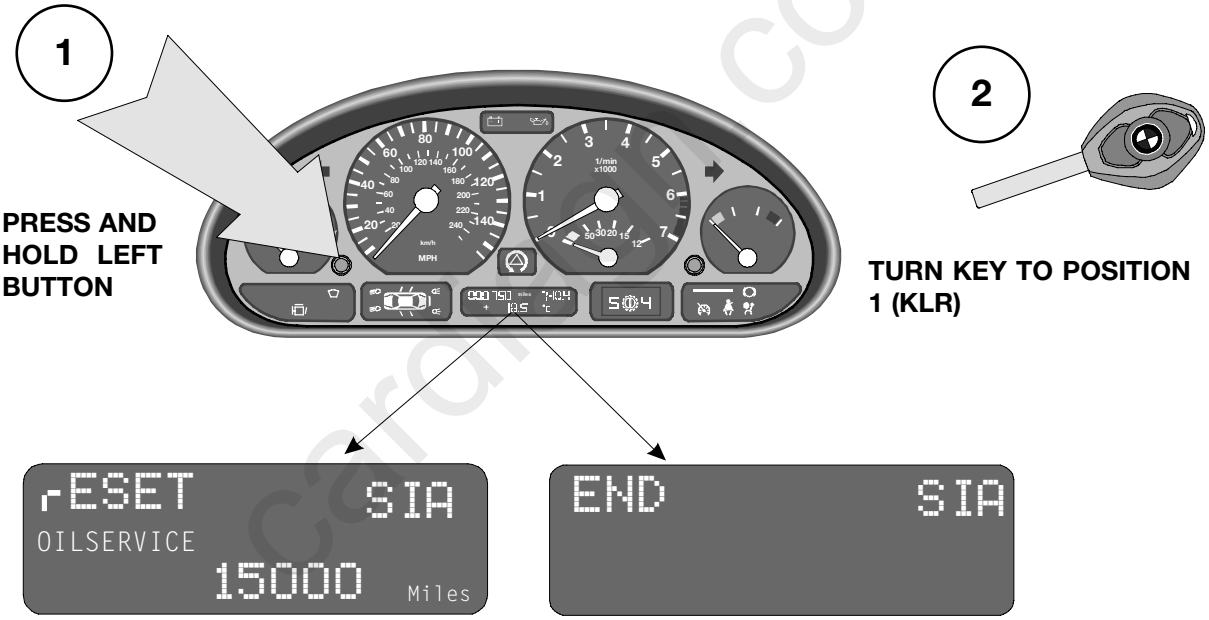
Reset procedure using the Reset Mode. **(possible from 9/99 onward for E46, MY2001 E52)**

- Ignition key must be “off”
- Press and hold the trip odometer button in the instrument cluster (left button), and turn the ignition key to the first position (KLR).
- Keep the button pressed for approximately 5 seconds until one of the following words appear in the display: “OIL SERVICE, or “INSPECTION”, with “reset”.
- Release the reset button and press and hold it again until “reset” begins to flash.
- While the display is flashing, press the left button briefly to reset the service interval. After the display has shown the new interval, the following will appear: “END SIA”

The system can only be reset again after 10 liters (2.5gal) of fuel have been consumed.



KEEP PRESSED FOR 5 SECONDS AFTER KEY IS SWITCHED ON.

TAP BUTTON TO RESET SI DISPLAY

E46 service interval reset

Reset using Diagnosis Program

- Connect the Diagnosis head to the diagnostic connector of the vehicle.
- Identify the vehicle and perform the Short Test.
- Select Function Selection and then Service Functions.
- Highlight Reset Service Interval Indicator (Test module S6211-00001)
- Select with tester.
- Follow the directions from the help information in the test module (upper right corner).
- Select which service is to be reset and press the continue key.
- An acknowledgement is displayed on the screen that the reset has been carried out.

Instrument Cluster Replacement

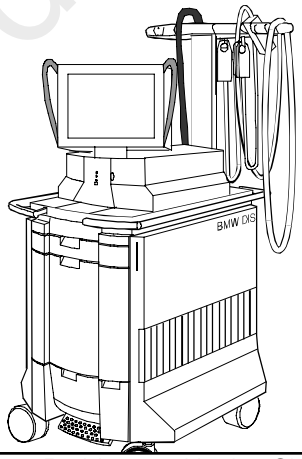
If the instrument cluster (Kombi) is replaced the SI data can be retrieved from the LSZ on E46 vehicles and from the LCM III on the E52. Coding procedures are the same as SIA II.

Diagnosis

Diagnosis of the SIA System is carried out using the Diagnosis program of the DISplus or MoDiC III.

System Test: Also possible from the Instrument Cluster Self Test, the Display Test illuminates the Service Interval Display. To enter the test:

- Function Selection
- Service Functions
- Body
- Instrument Cluster
- System Test
- Test Schedule



Read SIA Data: Displays Instrument cluster data as well as SIA data. SIA data allows the technician to verify that the SIA system is using the proper calculation as well as viewing the current status of the system. To enter

- Function Selection
- Service Functions
- Body
- Instrument Cluster
- Service Interval Indicator Data
- Test Schedule

Test Modules: Problems with the SIA System can be diagnosed using fault or Symptom driven test modules. To begin diagnosis:

- Short Test
- Select Symptom from Symptom selection page
- Select Test module from Test Plan Page
- Test Schedule

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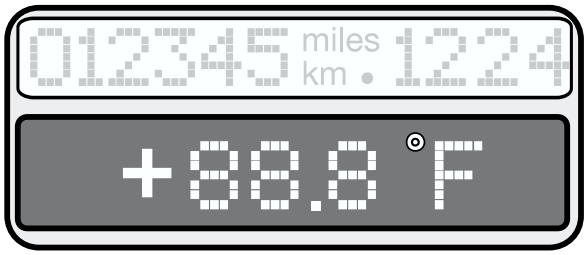
ON BOARD COMPUTER

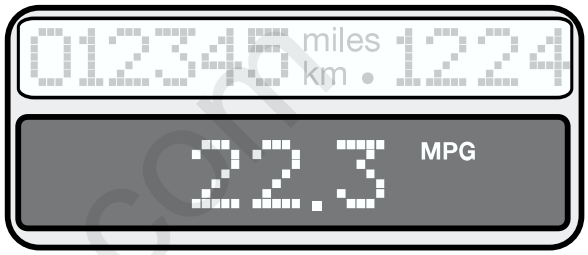
The On Board computer of the E46 contains the following functions:

- Time
- Outside temperature
- Average fuel consumption
- Driving range on remaining fuel
- Average speed

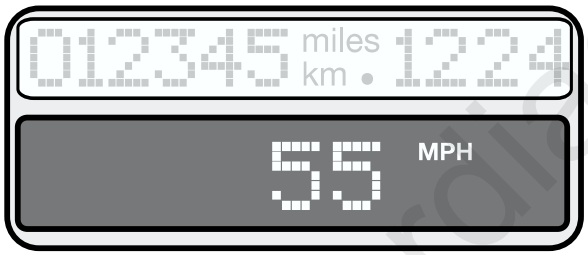
• OUTSIDE TEMPERATURE



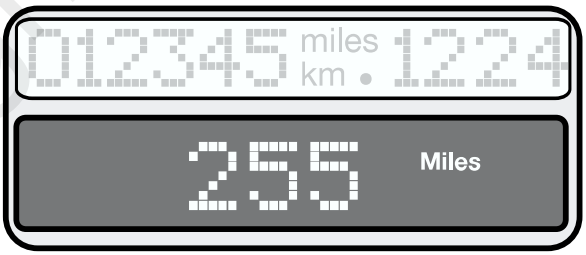
• FUEL CONSUMPTION



• AVERAGE SPEED



• ESTIMATED DRIVING RANGE ON REMAINING FUEL



The current time is always displayed when KL R is switched on. Any other BC display value can be called up by pressing the turn signal lever.

To set the clock “turn” the odometer reset button to the left or right to set the desired time.

To reset any other programmable displays - hold the turn signal lever in for > 2 seconds.

A freeze warning is incorporated into the BC. If the temperature drops below 37 degrees, the gong will sound and the temperature display will flash.

The displays of the Board computer can be changed over from Fahrenheit to Celsius by pressing the instrument cluster button and switching the ignition key on. IHKA display will also change over. The average fuel consumption and average speed displays are reset by pressing and holding the turn signal lever for > 2 seconds. The BC then starts to calculate new average values.

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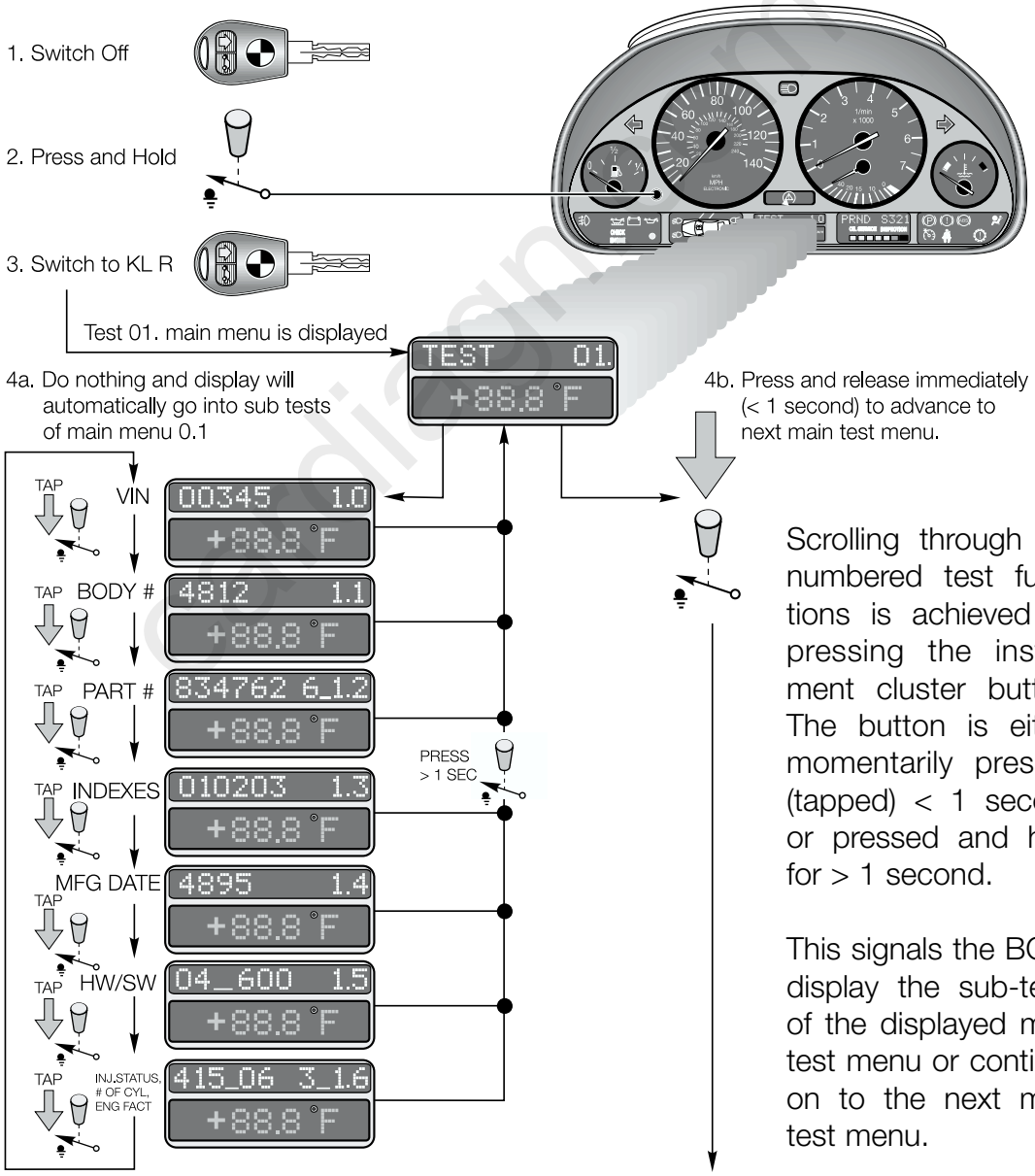
INSTRUMENT CLUSTER TEST FUNCTIONS

In addition to the fault memory and diagnostic link, the base instrument cluster contains a series of test functions that can be accessed to check various functions and values. The test functions are displayed in the mileage LCD block. There are a total of 21 test functions. The test functions are similar to those of previous Board computers and contain similar tests.

- Tests 1 & 2 are always unlocked.
- Tests 3 -21 are only accessible after unlocking the test function. Test 19 is the unlock function for accessing the displays.



Scrolling through the numbered test functions is achieved by pressing the instrument cluster button. The button is either momentarily pressed (tapped) < 1 second or pressed and held for > 1 second.

This signals the BC to display the sub-tests of the displayed main test menu or continue on to the next main test menu.

TEST 01. - Vehicle specific data including:

SubTests:

12345	**1.0**	= VIN
4812	**1.1**	= Body number
834762	**6_1.2**	= Part number of cluster
010203	**1.3**	= Coding/Diagnosis/Bus index
3495	**1.4**	= Manufacturing date (calendar week/year)
04_600	**1.5**	= Hardware/software # of cluster (HW:04, SW:6.00)
415_06	**3_1.6**	= Injection status, number of cylinders, engine factor

TEST 02. - Cluster System Test - activates the gauge drivers, indicators and LEDs to confirm function.

TEST 03. - SI data

Sub Tests:

1500	**3.0**	= Liters
0	**3.1**	= Periodic inspection days (not applicable for US).

TEST 04. - Momentary Consumption

Sub Tests:

0267	**4.0=**	26.7 liters/1000km
0073	**4.1=**	7.3 liters per hour

TEST 05. - Distance Gone Consumption

Sub Tests:

0195	**5.0=**	19.5 liters/100 km
226	**5.1=**	momentary distance to go (226km)

TEST 06. - Fuel level sensor inputs in liters

Sub Tests:

237415	**6.0=**	Fuel level averaged	• LH sensor input = 23.7 liters • RH sensor Input = 41.5 liters
0652	**6.1=**	Total tank level averaged = 65.2 liters	
0667	**1_6.2**	= Indicated value and tank phase	• 1 = both sensors OK • 2 = one sensor fault • 3 = implausible input

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TEST 07. - Temperature and Speed

Sub Tests:

032	**7.0=**	Coolant temp input 32°C
245	**7.1=**	Outside temp input 24.5°C
5283	**7.2=**	Engine speed 5,283 RPM
058	**7.3=**	Vehicle speed 58km/H

TEST 08. - Input values in HEX form

Sub Tests:

XXX	**8.0 - 8.3 =**	Hex code, Instrument cluster inputs

TEST 09. - Battery voltage

Sub Test:

125	**9.0=**	12.5 volts

TEST 10. - Country Coding

Sub Test:

02	**10.0 =**	US 02

TEST 11. - Cluster code

Sub Test:

000003	**11.0 =**	Cluster code

TEST 12. - Not Used

TEST 13. - GONG test

Sub Test:

Gong	**13.0 =**	Activate gong by pressing button (gong response is delayed).

TEST 14. - Fault memory (not for diagnosis)

TEST 15 to 18 - Not used

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TEST 19. - LOCK/UNLOCK

Sub-Tests
L-ON...
L-OFF 19.0 =

Display changes from “L-ON” to “L-OFF” every second. To unlock test functions, press the cluster button **immediately** when it changes to “L-OFF”.
Tests are automatically locked when exiting test functions.

TEST 20. - Not Used

TEST 21. - Software reset

Sub-Test:
reset 21.0 = Reset software

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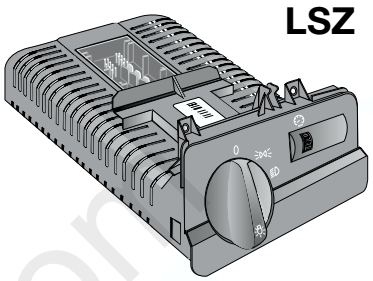
LIGHT SWITCH CENTER (LSZ)

The Light Switch Center is a compact component that combines the electronic control, switching, and monitoring for all exterior lighting on the E46. In addition the LSZ controls the illumination and intensity of the instrument cluster lighting and LCD blocks. The LSZ assembly is mounted in the dash and consists of two serviceable components; the switch assembly and the control module.

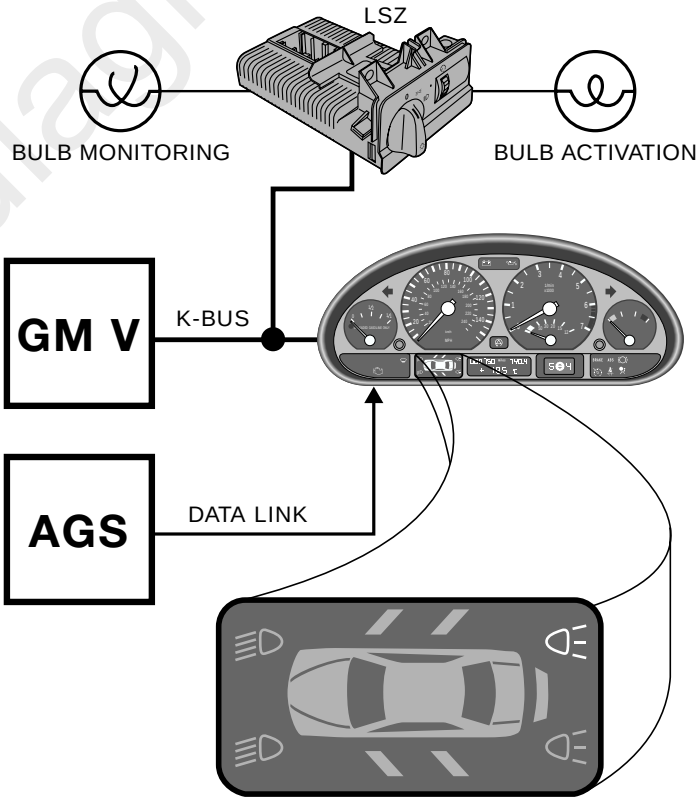
The LSZ provides the functions of the LCM including:



- Hot and cold monitoring of the exterior lights.
- Emergency lighting function
- Short circuit protection
- Redundant storage of mileage and SI data

The total scope of the LSZ system includes the following:

- LSZ control module
- LSZ switch assembly
- High-low beam/turn signal switch
- Brake light switch
- Hazard warning light switch
- Fog light relay
- Exterior lights
- Dash/LCD lighting



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COMPONENT OPERATION

The LSZ control module receives inputs from the following switches:

Headlight/parking light switch, fog light switch, potentiometer and photo-transistor mounted in the LSZ switch assembly.

- These inputs are received directly from the LSZ switch assembly.

TURN SIGNAL/HIGHBEAM SWITCH

- The turn signal and headlight (high/low) beam are resistance coded inputs over two wires to the LSZ control module. The LSZ carries out the switching function based on the voltage drop input.

HAZARD WARNING SWITCH

- The hazard switch provides a ground input to the LSZ to control the operation of the hazard warning lights.
- The hazard warning lights will be switched on in the event of an accident from the crash sensor input provided by the MRS control module.

BRAKE LIGHT SWITCH

- The brake light switch is a hall sensor that receives power when KL R is switched on. The switch is low until the brake pedal is pressed. When the LSZ receives a high signal from the switch the brake lights are switched on.
- If the hall sensor fails, the brake lights will be switched on continuously.

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E46 Convertible Third Brake light

The E46iC uses Neon technology for the third brake light which is mounted in the trunk lid. The remainder of the exterior lighting circuits carry over from the E46 Sedan and Coupes.The Electronic brake light switch is the input to the LSZ for brake light activation. The LSZ, as an output, provides power to the Neon light module for activation of the light. The light module consists of the ignitor, and Neon tube.

The use of neon lighting provides several advantages to automobile manufacturers and consumers:

Light failures caused by shock and vibration are minimized, because neon operates without a filament.

The average life of the light is considerably higher as compared to incandescent bulbs.

Styling of the light includes a more uniform distribution of light across the lens, and neon tubes can be bent to conform to the contour of the vehicle.

Amber neon allows the use of a clear lens (for vehicle color schemes).

Neon enhances safety because of the extremely fast ignition time of the light (instantaneous braking signal), allowing other drivers more time to react.

Neon Technology

Neon (symbol Ne) produces a glow in a vacuum electric-discharge tube and is used extensively in the familiar advertising displays.

A neon light is a glass bulb or tube containing neon (gaseous element) at low pressure, and two metallic electrodes. To make a neon light, the tube is bent while warmed, to the desired shape and sealed at both ends. During the sealing process, electrodes are added at each end. An access port is left near one end and a vacuum is applied to the interior of the tube. After the air and humidity has been removed, the neon gas is added under low pressure and the tube is sealed.

The light produces a reddish-orange glow when an electric current (applied across the electrodes) is raised in voltage to the point at which it ionizes the gas in the tube. The voltage at which the light glows varies with the design of the tube. When the glass tube is ionized, the voltage drop across the tube is constant, regardless of the amount of current flowing through the tube. The neon glows with an even intensity throughout the length of the tube.

A variant of this is the glass tube containing ionized neon at very low pressure. The tube shines with a brilliant red glow if a high-voltage alternating current is applied to the electrodes sealed in the ends of the tube.

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LAMP MONITORING

Lamp monitoring on the E46 is a function of the LSZ control module. The following lamps are monitored in both the hot and cold states:

- High/low beams
- Brake lights - left/right
- Turn signal lights
- Tail lights
- Parking lights
- Side marker lights
- License plate lights

Hot monitoring takes place when the lights are switched by monitoring the current flow through the lamp filaments.

Cold monitoring takes place by the LSZ when the lights are switched off. The LSZ will briefly activate the lighting circuits and check for current flow through the lamps. The lights are not switched on long enough to illuminate the bulbs.

If the LSZ detects a defective bulb, a signal is sent to the instrument cluster and the warning is posted in the Check Control pictogram.

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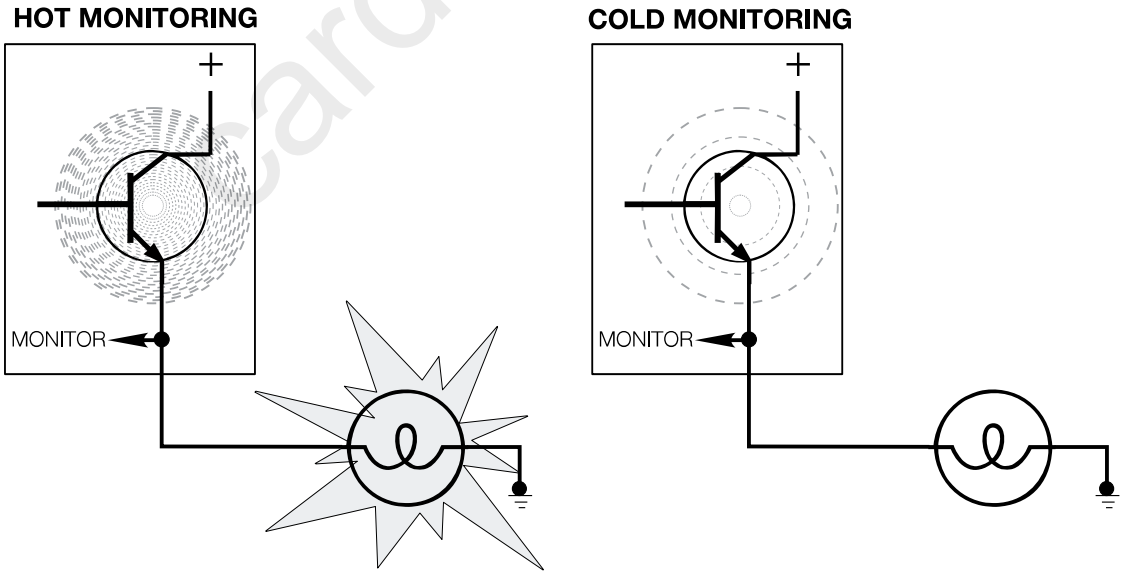
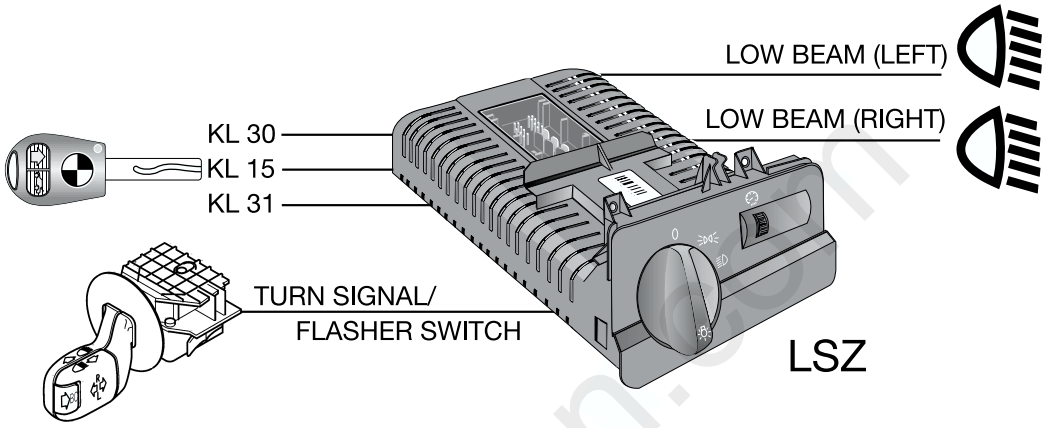


HOME LIGHTING

This convenience feature provides lighting for the driver and passengers to leave the vehicle and enter their house.

The feature is switched on by activating the headlight flasher switch after the lights and ignition are switched off.



The feature is switched off after the coded time delay or by switching the ignition switch on.

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REDUNDANT STORAGE

The LSZ serves as the redundant storage module in parallel with the instrument cluster. This includes all data used for vehicle identification which is encoded on the assembly line. In addition the total mileage and SI data are also stored in the LSZ.

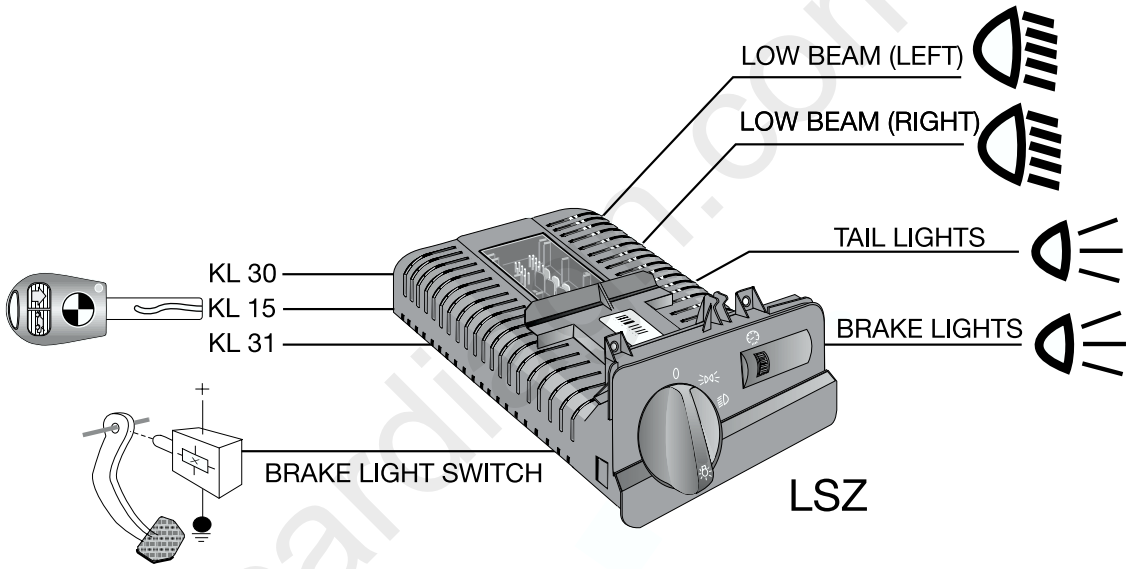
If either the Cluster or LSZ has to be replaced, the data is taken from the remaining module and transferred to the replacement unit. This can only occur ONCE the VIN has been entered into the replacement unit. Once the VIN is entered, the module becomes part of the vehicle and can not be interchanged with another vehicle.

EMERGENCY (FAIL SAFE) LIGHTING

The LSZ provides emergency lighting in the event of a control module failure. If the processor of the LSZ control module fails, back up hardware will allow the following lighting circuits to function:

- Low Beam headlights
- Tail lights
- Parking Lights
- Brake Lights

The headlights and tail lights will come on as soon as KL 15 is switched on, the brake will operate when the brake pedal is pressed.



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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:

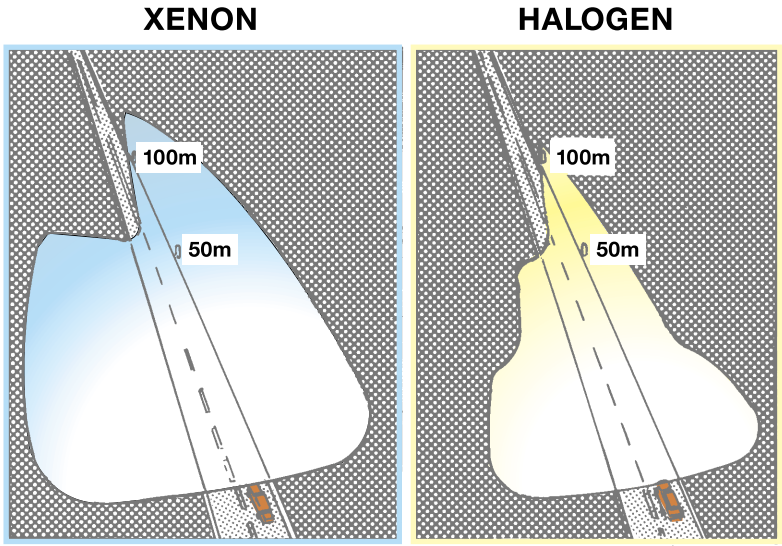
Xenon headlights provide the following benefits:

- **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.



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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 has been introduced on 1999 model year E38 vehicles. This system can be visually identified by the rounded bottom edge of the headlight assembly.

E46 Headlight

LWR: All 1999 model year systems 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 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-	**Bosch** (light) **Hella** (CM) Generation 3	Yes	Yes
E39 All	99-	**Hella** Generation 3	Yes	No
E46	99-	**Bosch (Light & CM)**	Yes	Yes

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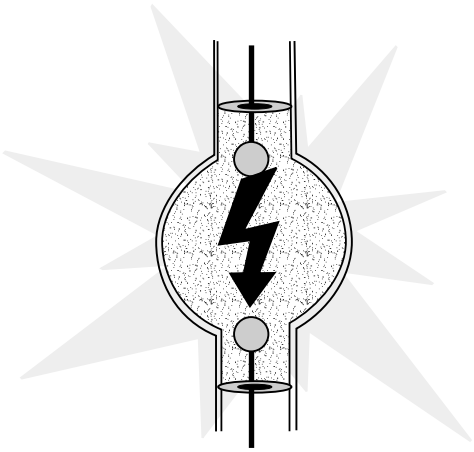
XENON HIGH INTENSITY DISCHARGE BULBS



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.

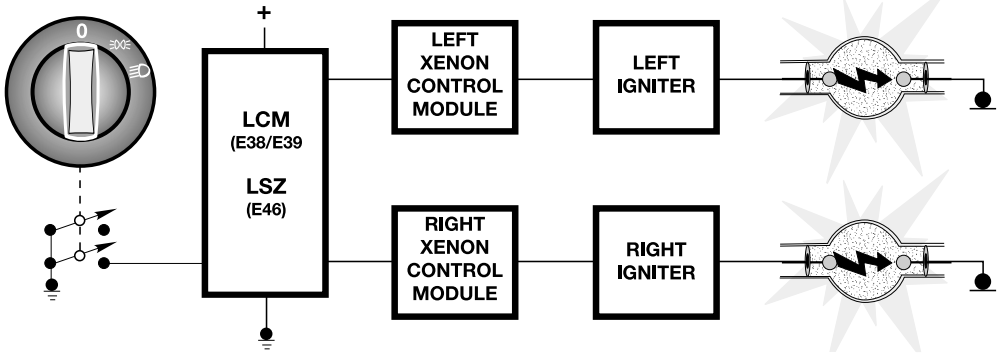
Warm Up Phase: Once the arc is established the power supply to the bulb is regulated to 2.6A generating a lamp output of 75 watts. This is the period of operation where the xenon gas begins to brightly illuminate. The warm up phase stabilizes the environment in the bulb ensuring continual current flow 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 -- LSZ E46) 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.



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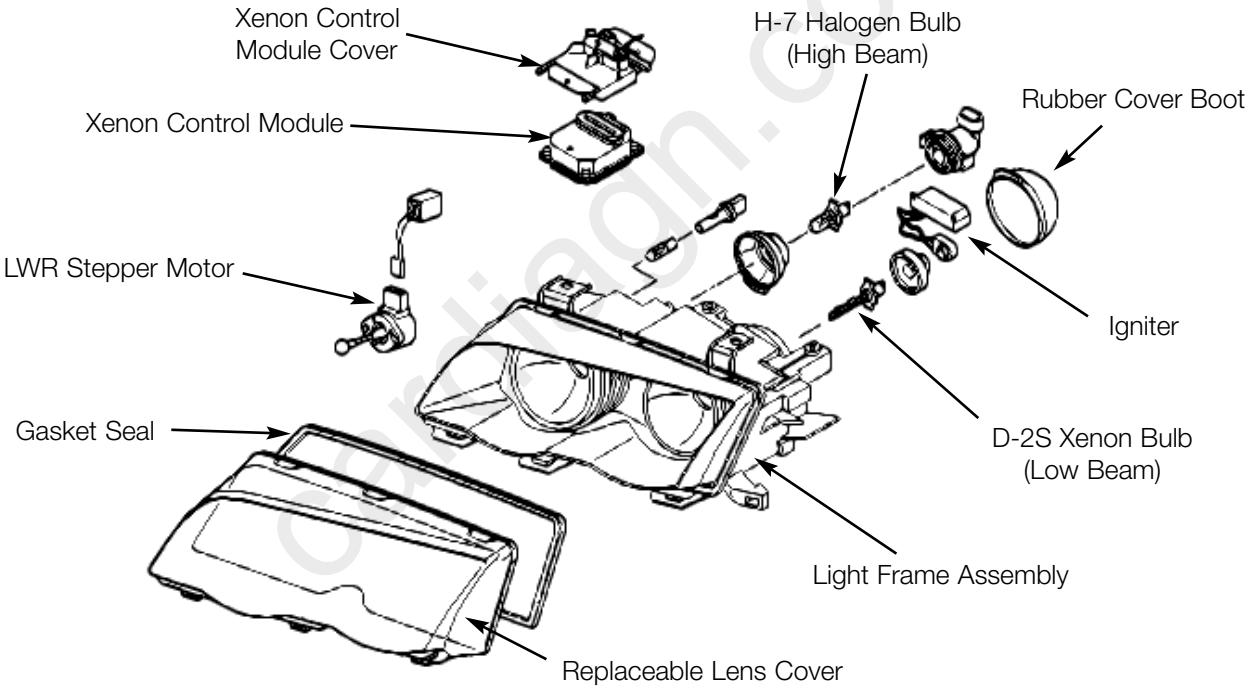
XENON BULB MONITORING

Xenon bulb function is monitored by the Lighting Control Module (LCM E38/E39 -- LSZ E46). 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 E46 and E39 Low Instrument Clusters.

XENON HEADLIGHT ASSEMBLY COMPONENTS (Example - E46)



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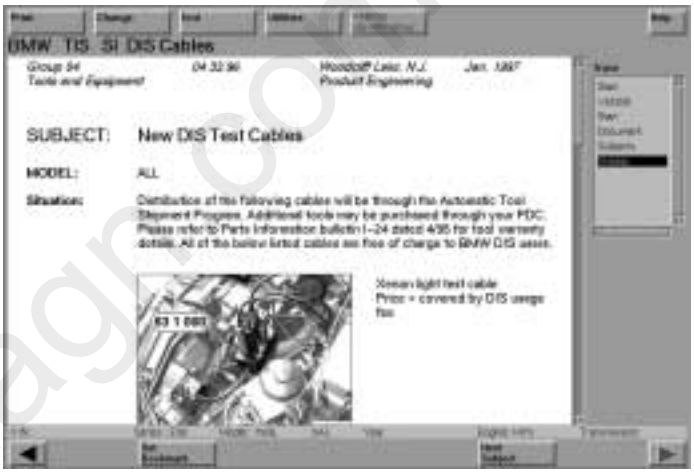
DIAGNOSIS

Xenon control modules are not connected to the diagnostic link. However, the vehicle specific Lighting Control Module (E38/E39 - LCM or E46 - LSZ) does incorporate xenon headlight specific diagnosis up to the xenon control module.

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.*



All xenon headlight systems (control module, igniter and bulb) can be tested with Special Test Adapter (P/N 90 88 6 631 000) in conjunction with the **DIS** Measurement System only.

Refer to SI 04 33 96 for detailed adapter introductory information.

The DIS Measuring System includes all of the cable connection information and test procedures in the "Xenon Preset Measurement".

The test provides an automatic oscilloscope setup and provides conclusive "defective/not defective" test results.

XENON HEADLIGHT SI/TRI BULLETINS

- **SI 6308 98:** Xenon Headlamp Reduced Service Life - 1999 740iL. This bulletin address a small group of possibly defective xenon control modules. This bulletin uses the special test adapter and specific oscilloscope setup procedures to check the xenon control module output.

- **SI 63 02 98**: E39 Headlight Alignment Procedure

- **SI 63 02 93:** Xenon Headlights - Color, Fuses, Warranty

- **TRI 63 01 92:** Gas Discharge Xenon Low Beam Headlights.

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HEADLIGHT BEAM THROW CONTROL- LWR

OVERVIEW

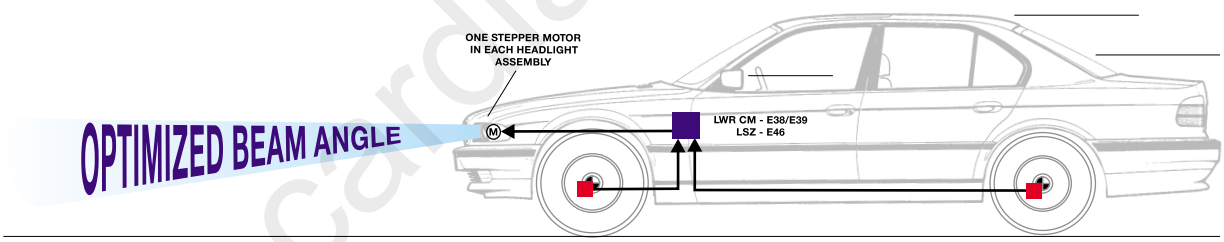
LWR automatically adjusts the vertical positioning of the headlights to maintain optimum headlight beam positioning for maximum driving visibility and to prevent undue glare for oncoming motorists. The system compensates for vehicle load angle changes (ie: diminishing reserve of gasoline in fuel tank 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 incorporate LWR as standard equipment. LWR is not available with standard halogen headlights.

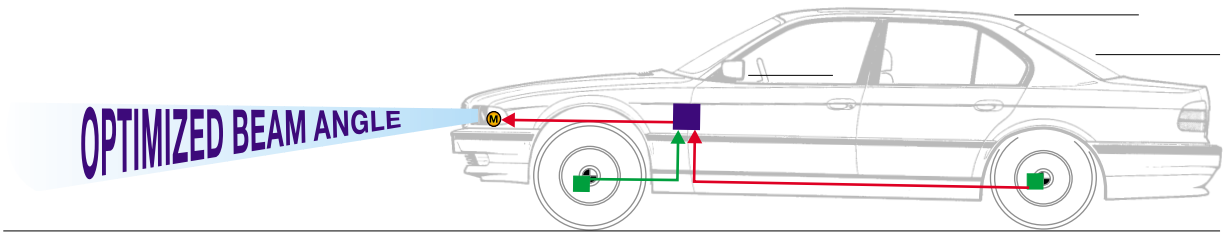
LWR monitors the vehicle's loaded angle via two hall effect sensors mounted to the front and rear suspension members. When an adjustment is necessary, LWR simultaneously activates two stepper motors (one in each headlight assembly).

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)



Note: LWR is identified in the Diagnosis Program as LRA.

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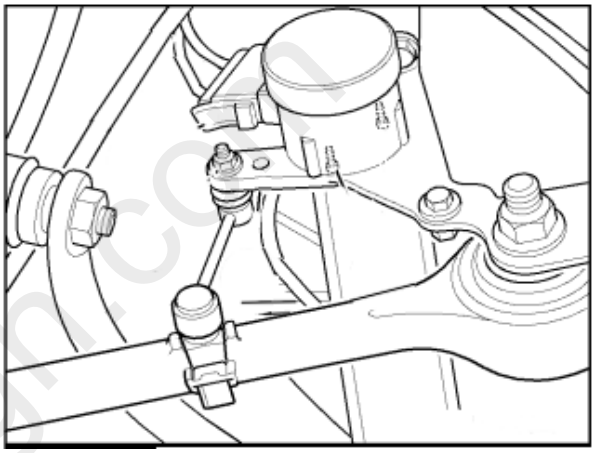
LWR COMPONENTS

CONTROL ELECTRONICS

LSZ - E46

The E46 LWR function is integrated into the control electronics of the LSZ. The LSZ monitors the required input signals to provide the LWR function and directly activates the stepper motors in the headlight assemblies. All LWR diagnosis is accessed through the LSZ 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.

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.

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FUNCTIONAL DESCRIPTION

The E46 LWR system comes on-line when the ignition switch is turned to KL 15.

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.

Abrupt fluctuations of the sensor signals are filtered to prevent unnecessary adjustment as well as monitoring road speed.

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 E46 LSZ incorporates LWR diagnosis program.

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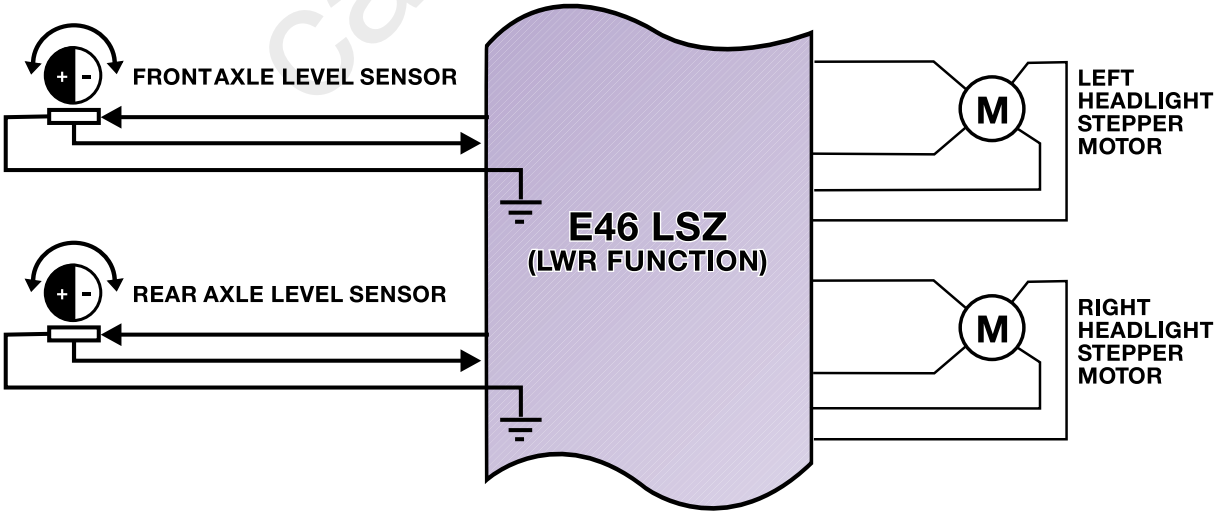
LWR SYSTEM IPO SCHEMATIC



MULTI-FUNCTION STEERING WHEEL

The multi-function steering wheel of the E46 corresponds to the MFL introduced on the E38 and carried over to the E39. The wheel contains two key pads on the left and right side of the air bag that allow activation and control of various driver convince systems.

As with previous MFLs, the left side key pad contains controls for the sound system and telephone. The right side key pad contains the controls for the cruise control.

The K-Bus is used for data communication between the sound system/telephone controls. The cruise control has its own data link to the DME control module for cruise control operation.