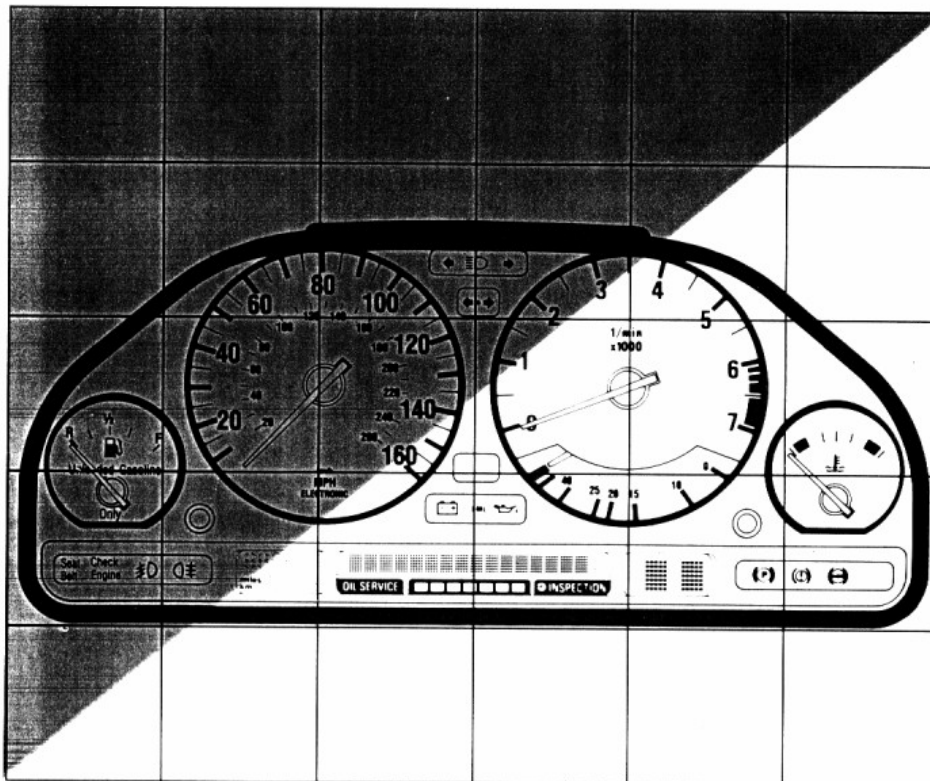
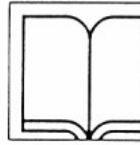


Instrument Cluster

Training
Reference
Book



Check Control



BMW of North America, Inc.
Service Training Department

DISCLAIMER

This training reference book is not intended to be a complete and all-inclusive source for repair and maintenance data. It is only part of a training information system designed to assure that uniform procedures and information are presented to all participants at the BMW Service Training Center.

The technician must always refer to and adhere to the following official factory service publications:

1. Service Information
2. Repair Manuals
3. Specifications Microfiche
4. Technical Reference Information
5. Video Bulletins

Note: The information contained in the training course materials is solely intended for participants in this training course conducted by the BMW Service Training Center.

Information status January 1989.

For changes/additions to the technical data, please refer to the current information issued by the "Service Division".



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INTRODUCTION

When compared to previous instrument clusters, this cluster is more advanced with expanded display capabilities. It is interconnected via data leads to other control units in the vehicle.

The check control display is integrated in the instrument cluster, with L.C.D's used for certain display functions.

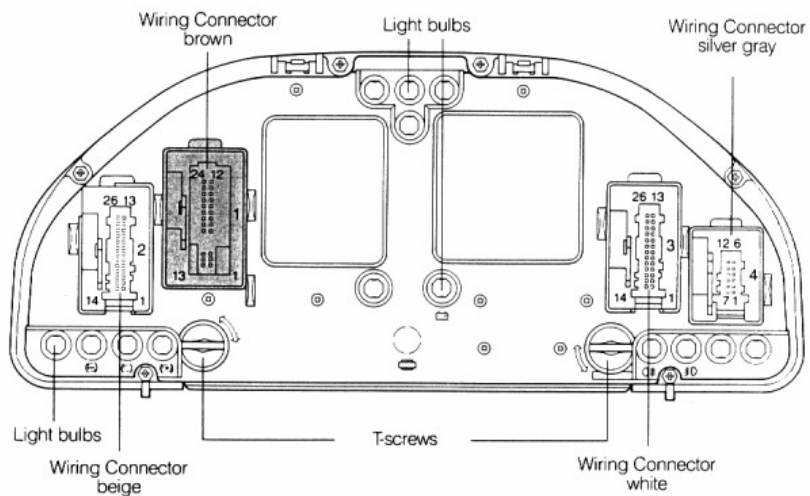
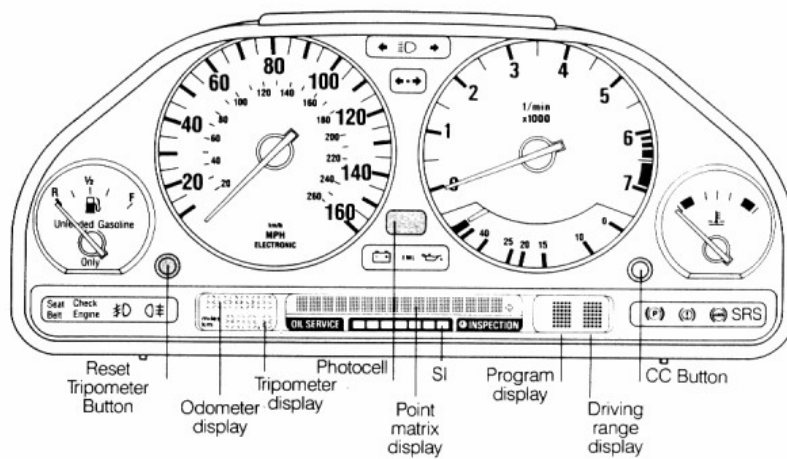
Separate leads are used for the exchange of data between the check control module, instrument cluster and lamp control module.

The analog instruments are positioned in the primary field of view. The displays of odometers, check control, service indicator and both range/program for the automatic transmission are arranged as digital displays in the lower section of the cluster.

The control lamps for high beams, turn signals, battery charge, oil pressure SRS, ABS, foglights, check engine and brakes are located between the instruments at top and bottom, where they are in view of the driver.

Advantages:

- Module designed instrument cluster
- Plugs with positive lock for better contact
- L.C.D point matrix display field
- Plug in components
- Diagnostic capabilities
- Capability for LCD display in other languages



CODING PLUG

The coding plug, stores vehicle and cluster operating data. It is located on the back of the instrument cluster.

The coding plug contains a **NV-RAM**.
**NON VOLATILE RANDOM ACCESS
MEMORY (NON-ERASABLE)**

Each coding plug is given a code number, with which the programmed coding data can be recognized. In order to display the coding number; on vehicles produced prior to 2/89, the daily odometer reset button has to be pressed and held in with the ignition turned off. Then the ignition key is turned to "R"; the code number is displayed as long as the reset button is held in. Everything returns to normal after releasing the button and the daily mileage reading is not changed.

For vehicles produced 2/89 and later, hold the check control button in. Then turn the ignition key to "R".

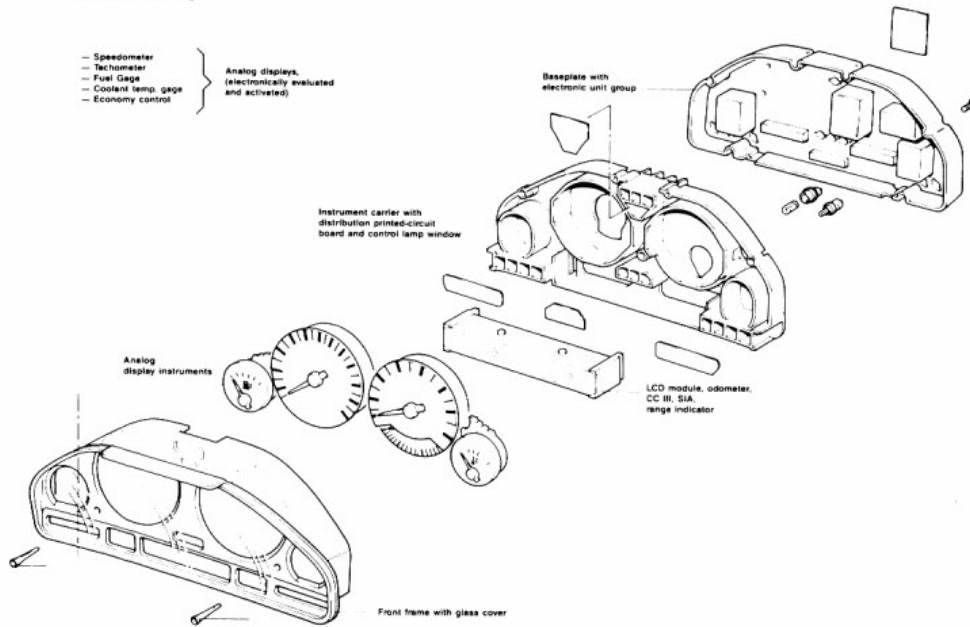
The LCD matrix will display the coding plug number as well as other information. The display ends with an instrument cluster self test or function test.

Examples of NV-RAM contents:

- Total odometer mileage
- S.I. information
- Code number of coding plug
- Fuel gauge support valves
- Temperature gauge support values
- Number of cylinders

COMPONENTS OF INSTRUMENT CLUSTER

Instrument Cluster Design



GENERAL DESCRIPTION

Power Supply

The instrument cluster is activated from ignition lock position "R" on. Power and ground are continuously supplied to the service indicator, check control and daily trip odometer as well as supply power for CC logics and lights.

Road Speed Indicator (Speedometer)

The display of road speed is accomplished with an analog instrument.

Signals from the rear axle reed contact are supplied to the instrument cluster, where they are transformed into speed-proportional current.

Tachometer

The analog signals come from the DME control unit. The frequency is converted into an indicator deflection by the cluster circuit board.

Temperature Display

The analog signal is processed in the instrument cluster and compared with data stored in the coding plug. A corresponding signal is sent to the instrument. Five temperature support values are stored in the coding plug.

Exceeding the temperature limit stored in coding plug will additionally send corresponding warning information to the check control and display it there.

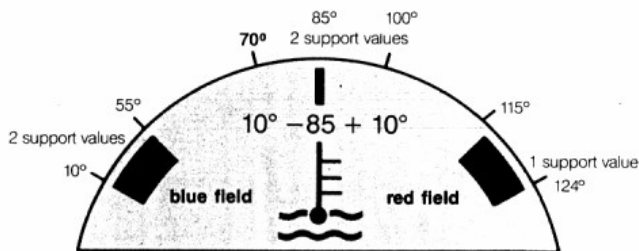
Economy Control Display (EC)

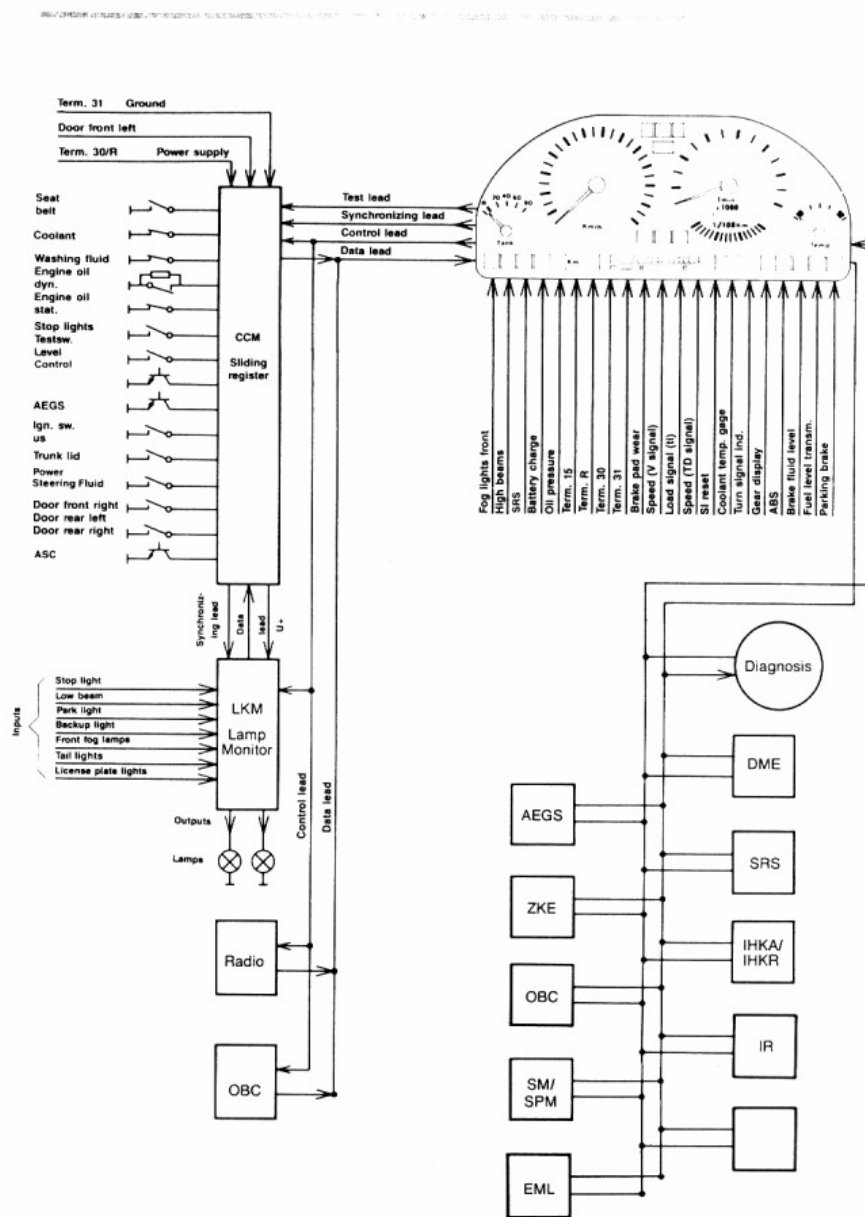
The EC (instantaneous fuel consumption) is activated by a microprocessor. The road speed signal from the rear axle reed contact and the injection signal Ti serve as basic information for this purpose.

The Ti signal comes from the DME control unit, is processed in the instrument cluster and delivered to the EC. In addition, at idle speed (car stopped) the indicator will disappear underneath a mask and no longer point to maximum fuel consumption as in the past.

Tank Display

The fuel level transmitter is supplied with power at term. "R". A voltage signal dependant on the fuel level, is processed in both the instrument cluster and BC. The actual transmitter value in gallons is input for approx. 4 minutes. Afterwards the signal is dampened strongly to prevent an inaccurate display when driving in curves. The fuel reserve display (contact closed) is indicated by a warning lamp in the fuel gauge.





LC Display

The Display block has three light chambers.

1. Point light matrix and SI display
2. Driving range/program display
3. Mileage display

The LC display is controlled with a phototransistor. The brightness of the display will increase as more light is applied to the transistor.

Check Control (CC)

The CC display is a 16 character point matrix display.

Service Indicator (SI)

The activation of the "Oil service" and "Inspection" indicators is based on the parameters of engine speed, engine temperature and distance pulse.

The SI is reset with the conventional service indicator resetter, however an adapter has to be used on the diagnosis jack.

Odometer

The distance pulses taken from the final drive (reed contact) are converted into miles by a micro-processor.

The total driven distance is continuously stored in NV-RAM. A maximum odometer reading of 999,999 miles is provided.

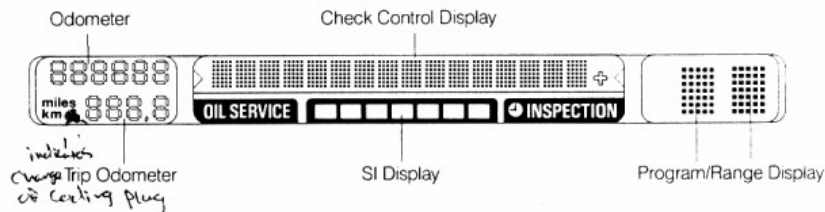
The **daily trip** odometer is shown in a separate display up to a distance of 9999 miles. There is then automatic over-running to 0000 miles. This odometer can be reset to zero at any time with a reset button in the instrument cluster

Range and Program Indicator (Automatic Transmission)

The driving range and program display is shown as a single-digit point matrix in the instrument cluster. The driving range display of different position of the transmission switch (P, R, N, D, 3, 2, 1) are transmitted to the instrument cluster via four coded leads.

The program display is needed for independent electronic transmission control cars (AEGS) to show the selected program. The signal is delivered via coded leads. Three different displays are possible.

E = Economy
S = Sport
M = Manual



CHECK CONTROL SYSTEM

Check Control System

Check control is an active information system, which reports

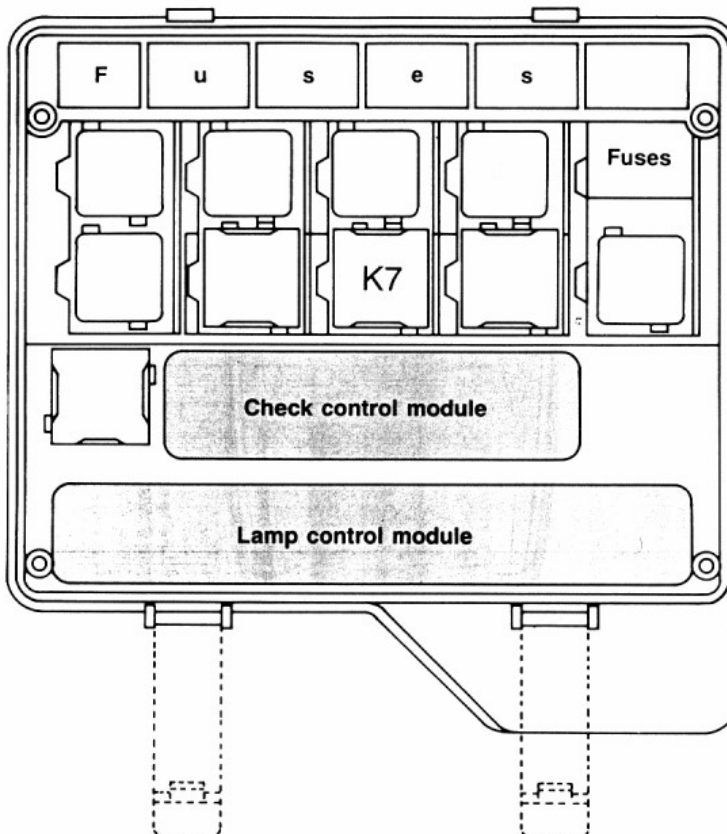
- failure of important functions,
- instructions and warnings via an alphanumerical display in the direct view of the driver.

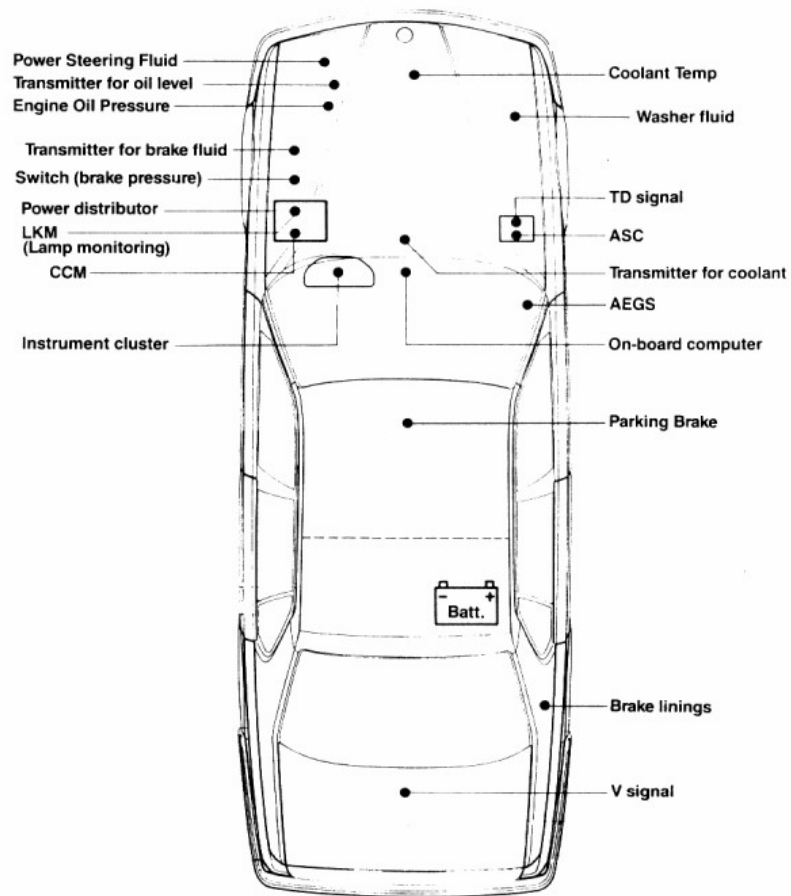
The functions are assigned to priority groups depending on their importance and displayed in text form (example: oil pressure has priority over washing fluid).

An acoustic signal is produced in addition to the text display for emergency warning reports. A "+" sign will appear when there is more than one defect. This arrangement makes it possible to send a lot of information to the driver, without using a complicated system of warning lamps.

Check control works together with the following components:

- On-board computer
- Lamp control module (LKM)
- Other instruments





DISPLAY OPERATION

Check Control Module (CCM)

All sensors, excluding those specified by legislation and leading direct to the instrument cluster. The defect is evaluated, and a corresponding text is displayed.

Plus Sign

If a plus sign appears in the text line to the right, it shows that there is more than one defect stored in the memory.

Acoustic Indication (Gong)

An acoustic signal (gong) is produced in addition to the text display when an emergency defect is concerned, e.g. defects of priority group 1.

CC Button

If several defects occur simultaneously (plus sign in addition to text), the additional defects can be displayed with the CC button, beginning with the defect having the highest priority.

On-board Computer/Instrument Cluster Remote Control

The BC information can be displayed in the instrument cluster by using the remote control steering column switch. This is only possible when there is no check control information displayed.

Languages

The primary language is selected on the coding plug. The driver can select a different language with the CC button, when the ignition key is in position "R" and the CC button is pressed at least 10 seconds. The language designation appears in the display. The CC button must be pressed again for 10 seconds to switch to the next language. The newly selected language is stored until another language is selected or power is disconnected from the check control module. If power is disconnected the CC module returns to the primary language.

PRIORITY GROUPS

The two priority groups of the check control will be displayed as follows:

Priority 1

Text with continuous display:

- Includes such defects which could have direct influence on the handling or operating safety of the car.
- The displayed text lights up immediately in case of defect.
- These defects cannot be cancelled with the CC button.
- If several defects are reported simultaneously, only the last defect will be displayed with a + sign.
- A gong will highlight the importance of the defect.
- The other defects can be displayed by pushing the CC button.

Priority 2

Text display with ignition "ON" and "OFF"
– 20 second display only with car stationary:

- Includes reports concerning actual fluid levels and general information.
- Text lights up from ignition lock position 15 and after stopping the car or with the ignition lock in position "O".
- Reports can be called with the CC button within about 2 min. after stopping the car.
- If several defects occur simultaneously, the one with the greatest importance and the plus sign will be displayed.

DISPLAY SCOPE OF CHECK CONTROL III – PRIORITY I

Text	Cause
* Brake pressure	Closed circuit to ground from either 2 bar or 22 bar pressure switch, engine running
* Low brake fluid	Closed circuit to ground via brake fluid level sensor circuit, >25 sec.
* Engine oil press	Closed circuit to ground via oil pressure switch, engine running
* Coolant temp	Closed circuit to ground via black coolant NTC
ASC	Closed circuit to ground via ASC control unit, ASC in operation
* Parking brake on	Closed circuit to ground via park brake switch, road speed >6 MPH
Brake light	Open circuit in any brake light—warm monitoring only
Brake light	Open circuit, i.e. failure of stop light switch—test switch must be operative
Transmission	Failure of AEGS system, engine running
ASC not active	Closed circuit to ground via ASC control unit, ASC fault.
* Brake linings	Open circuit in brake pad wear sensor
Low beam	Open circuit in low beam—cold and warm monitoring
F/side light	Open circuit in <i>both</i> adjacent front park and side marker lights—cold and warm monitoring
Tail light	Open circuit in <i>both</i> adjacent taillight and rear sidemarker—cold and warm monitoring
Front fog light	Open circuit in fog light—cold and warm monitoring
Lic plate light	Open circuit in license plate light—warm monitoring only
Door Open	Closed circuit to ground via door contacts, road speed >0.6 MPH
Trunk open	Closed circuit to ground via trunk lid switch, road speed >0.6 MPH
Shelf level susp	Closed circuit to ground via camber warning switch, 8 min. delay

* Indicates text will display, i.e., failure will be recognized, with CCM inoperative.

DISPLAY SCOPE OF CHECK CONTROL III — PRIORITY II

Text	Cause
Engine oil low	Closed circuit to ground via oil level sensor dynamic contact
Pow steer fluid	Open in power steering fluid level switch. Early production vehicles have bridge installed in lieu of switch.
Check control	CC failure
Coolant level	Open in coolant level sensor circuit
Washer fluid low	Open in washer fluid level circuit
Oil press sensor	Open in oil pressure switch circuit
Oil level sensor	Open in dynamic oil level sensor circuit (dynamic contact and 1K OHM resistor)

DISPLAY SCOPE OF CHECK CONTROL — NO PRIORITY ASSIGNMENT

Text	Cause
Light On?	Park lights on, key removed and driver's door open
Fasten belts	Key in run position (KL. 15), will sound gong four times if driver's seat belt not secured. Text is displayed when key first turned on, even with belt fastened
Key in ignition	Key remains in ignition after turned off, and driver's door opened
Owner's hand book	Text supplied only in addition to a Priority 1 or Priority 2 fault

MONITORING SCOPE

Priority 1

Brake pressure — reservoir 22 + 2 bar / circulating pressure 2 bar. Both switches for reservoir and circulation pressure are designed as ground switches and have direct connection with the instrument cluster to illuminate the bulbs. A brake pressure warning is only indicated when exceeding a speed limit of 450 rpm and only 10 seconds after exceeding this limit.

Parking Brake

An applied parking brake will only be reported when the car has reached a speed of at least 6 m.p.h. A ground signal is sent direct to the instrument cluster to illuminate the bulbs.

Brake Fluid

The brake fluid level transmitter has direct connection with the instrument cluster to illuminate the bulb.

If the brake fluid level drops to minimum while driving, a ground signal will be sent to the instrument cluster by the level transmitter. If this signal remains in the evaluation unit > 25 seconds, the defect is recognized and will be displayed.

Oil Pressure (Engine)

The oil pressure switch (0.2-0.5 bar) is installed. An oil pressure warning is only indicated when exceeding a speed of 400 rpm. The ground signal must remain 10 seconds before the defect will be recognized and displayed.

Coolant Temperature

The input analog signal is processed in the instrument cluster, compared with data stored in the coding plug and the temperature display is activated.

If the engine temperature is exceeded (needle moves into red zone) "coolant temp" appears in the display and the driver is warned with a gong.

Autom. Transm. Electronics Def.

Failure of the electronics is reported to the CCM. A defect is only reported after exceeding a speed limit of 500 rpm for 1.5 seconds.

Brake Pads Worn

A signal is sent to the instrument cluster when brake pads are worn. The defect will be evaluated and displayed.

Leveling Suspension

A signal is sent to the CCM if the camber warning switch detects out of spec condition at the rear of the vehicle.

Note: There is a delay built into the system to allow for dynamic movement while driving.

ASC Display

Two reports are sent to the CCM. One for ASC activation and one for a faulted ASC system.

An open door is reported after reaching a speed of .6 mph. The text is displayed together with a gong. The CCM receives a ground signal from the pertinent door contact.

An open trunk lid is reported only the first time that a road speed of .6 mph is reached.

Doors, engine hood or trunk lid closed
switch open.

Stop Lights, Stop Light Switch, Stop Light Test Switch

Stop lights and leads are only monitored in switched on state.

LKM

The LKM (lamp control module) is located in the power distributor.

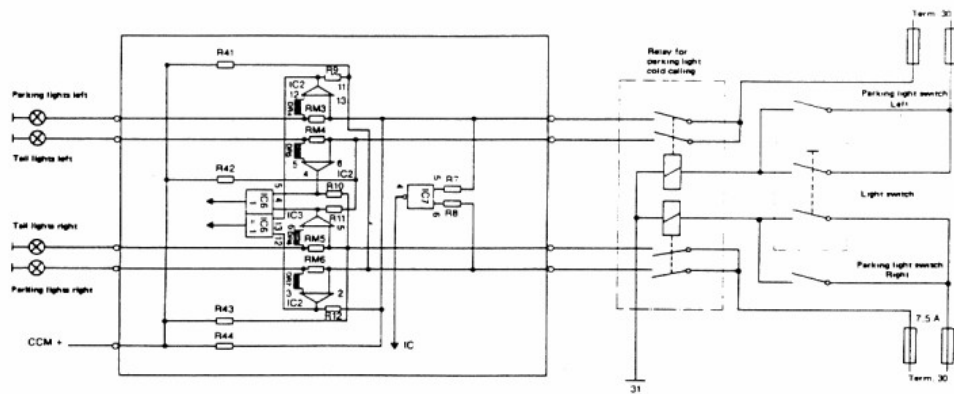
Lamp operation is controlled and monitored by the LKM. Warm and cold monitoring takes place so that defects are reported regardless of switch position.

Failure of Lamps:

Various lights or light circuits integrated in the check control are monitored when the lights are on and off, i.e. The failure of a low beam will be recognized whether the light is switched on or off (warm/cold monitoring). A defective light or interrupted load circuit is recognized by the lamp control module, evaluated and displayed in the instrument cluster for the following lights

- Low beams
- Parking lights
- License plate lights
- Tail lights
- Front fog lights

Lamp Control Module (LKM)

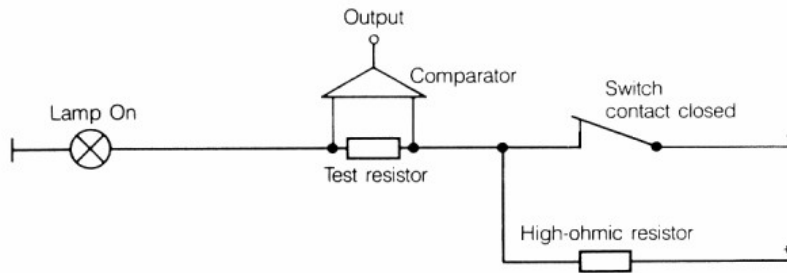


COMPARATOR

Function of Lamp Monitoring

Comparators are used in the E 32 to monitor lamps and switches.

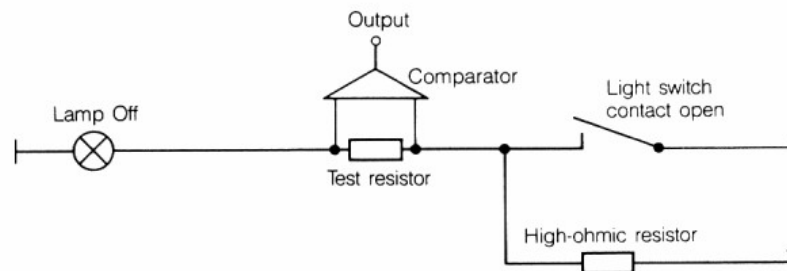
A comparator has an electronic switching function. A voltage drop is produced by a test resistor in both on/off switch conditions.



Warm Monitoring

If current is flowing to ground via the lead, test resistor and lamp, there will be a voltage drop (max. 100mV). No fault signal is produced at the output.

If the circuit is interrupted, i.e. failure of lamp, current cannot flow and there is no voltage drop across the resistor. The comparator now switches over and a signal is produced at the output.



Cold Monitoring

When the contact in the light switch is open; the lamp is not on. Limited current (approx. 1 mA) can flow to ground via the load current lead, test resistor, lamp and high-ohmic resistor.

The test resistor has a voltage drop across the resistor and output has no signal.

The output will have a signal when the circuit is interrupted.

PRIORITY 2

Check Control Module

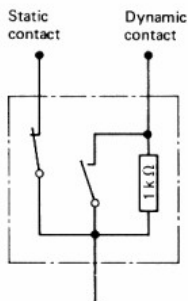
In case of CC module failure or problems in the data leads the text "Check Control" is displayed. The driver is warned that any possible defects from sensors, which are connected on the CC module, cannot be displayed.

Engine Oil Level

The oil level sensor has two switch contacts:

- static contact
- dynamic contact

The static contact is closed when the oil level is sufficient. The dynamic contact is open and the monitoring voltage flows against ground, through the 1K ohm resistor. A defect is reported when the oil level drops below the dynamic switching point. The defect report remains stored in the memory, so that it is not cancelled when the oil level rises after stopping the engine. The defect report is only cancelled, when the static contact closes.



Washing Fluid, Coolant Level Transmitters

The same type of level transmitters with reed contact and magnetic ring are installed as before. A voltage signal is sent to the level transmitter via a high-ohmic resistor in CCM

The float with magnetic ring is up and the reed contact closed when the level is sufficient. If the fluid level drops to a minimum, the float will also drop and the reed contact opens. CCM now has a voltage signal; this defect report is sent to the instrument cluster and stored in the memory. The defect is displayed and the gong operated when stopping the car or turning the ignition key to 0.

Power Steering Fluid

Low power steering fluid will be recognized and displayed in the check control with an open circuit through the PS fluid level switch.

**CHECK CONTROL DISPLAY
(No Priority Assignment)****Fasten Belts**

The text "FASTEN BELTS" with a gong, is displayed 6 ± 2 seconds each time the ignition is turned on. The gong is stopped by fastening the seat belt.

Ignition Key

"KEY IN IGNITION" will be displayed when stopping the car, leaving the key in ignition lock position 0 and opening the door. The gong will also be operated. Both indicators will stop by closing the door, removing or turning the ignition key.

Light on?

The text "Light on?" will be displayed each time the drivers door is opened with the lights left on.

Owner's Hand Book

The text "Owner's Hand Book" is displayed after certain faults. To direct the driver to possible corrections for the fault display.

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