BMW E34 5 Series 1988 – 1992 Electrical Information

This text has been compiled from many sources to help aid E34 owners to fault find, repair, upgrade or just simply for some useful information. Topics covered include, OBC retrofit, OBC operation/hidden functions, instrument panel, security alarm, electrical schematics, and more. Note as with all electrical work on a vehicle the battery **must** be disconnected first.

- OBC IV Retrofit, 525i, 530i, 535i, 540i.

For many reasons, if you own an E34 5 series you may wish to install the onboard computer (OBC). Generally, if your E34 came from the factory with an analogue clock, digital clock/timer combo or a digital clock/outside temperature combo it is possible to upgrade to the OBC. The clock units use the same connector as the OBC and all or at least most of the wiring is already in place. Note not all E34's were fitted with the full wiring loom to allow OBC installation, if you have one of these cars then this text is not for you.

I say most because on some E34's the connectors for the outside temperature sensor and the auxiliary horn (the auxiliary horn is used by the OBC) are not there, although with some investigation the wiring for these connectors may be found taped up in the loom on the near side under the bonnet.

Cars that only had an analogue clock may not have these connectors, so the temperature function will not work, also the auxiliary horn (used in conjunction with the CODE function) will not be fitted. All other OBC functions will operate normally, including the CODE function (it will just be silent if a wrong CODE is entered). See table 3 below.

Cars that have the instrument cluster with no check control will most likely have no gong so the OBC will stay quiet about ice and speed limit warnings, giving visual warnings only. For cars with check control, the OBC will blend all it's messages onto the check control display. Audible warnings will also be given via the gong.

Parts Required

OBC Unit

First things first, you will need to acquire an OBC unit – These can be purchased from a specialist BMW breakers yard and should cost about £20 – 30. Don't even think about going to BMW for one. (You won't get much change from £500).

E34's were fitted with two different types of OBC (see fig 2), one for the 518i/520i and one for the 525i, 530i, 535i and 540i. On the 518i/520i the coding plug on the instrument cluster can't communicate with the OBC, therefore an OBC with another coding plug built into the back of the OBC was fitted to these cars, **so be aware of this fact when purchasing your OBC.** If you have one of these OBC units, you will probably get the famous **PPPP** error.

Other Parts

There are three other parts required, but not essential as the OBC can be fitted without them and will still function normally. The first of these items is the frame the OBC is mounted into (which also houses the radio and heater control module) as it differs from the analogue clock's frame (see table 1 for part numbers). The OBC frame has a deeper aperture, as the OBC is nearly twice the depth of the clock and the connector for the OBC is located higher than on the clock. However, it is still possible to use the existing frame by cutting away the plastic at the back of the frame to accommodate the OBC but the ideal way is to replace the frame.

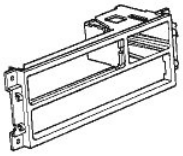
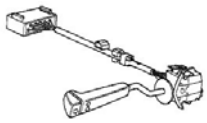


Table 1		BWM Part Numbers
Description	**Part Number RHD**	**Part Number LHD**
Holder Radio/OBC	65 81 1 384 121	65 81 1 384 140
Holder Radio/Clock	65 81 1 384 141	65 81 1 384 142

The second of these items is the indicator switch, which has the OBC remote control button built in. This should be a straight swap and the wire for the OBC remote should be in place as well, so just plug and play.



Lastly, the third of these parts is a temperature sensor and associated wiring. As mentioned earlier, E34's that were only fitted with the analogue clock may not have the connector for the outside temperature sensor (or the one for the auxiliary horn). But, if your fortunate enough to find an E34 in a breakers yard that had this wiring you could cut it out of the loom and fit it to your own car. Details of this will be given later on in this text.

The Procedure

Step One – Analogue Clock Removal.

The first step is to remove the old analogue clock unit. This is achieved in the following manner: - Remove the radio and it's mounting cage/frame from the console, look inside the space where the radio was and you should see a lever towards the top of the clock unit, See fig 1, the red dot shows approximately, where the lever is (the holder shown is the left hand drive version). You need to push this lever towards the engine, which should eject the clock unit from its location enough for you to grasp it with your fingers. Then you can remove the clock completely by pulling it gently toward you.

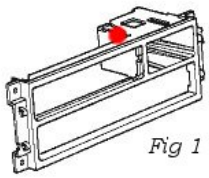


Fig 1

Step Two – Getting the OBC to Work.

The next thing to do is try your OBC to see if it works. The connector is clipped into the back of the mounting frame, unclip it and pull it out a little (there should be about two inches or so play in the loom). Now plug it into the back of the OBC, it will only go in one-way round. Turn the ignition on and see if your OBC comes to life. If it does then great, you can start using it with the restrictions mentioned earlier. The chances are though it will not, in most cases. The most likely reason for this is that, your car does not have the factory alarm fitted (the one with an infrared key fob & control box located under the back seat on the near side) or your car does not have the auxiliary horn relay fitted (also located under the back seat). This results in power being missing from pin17 on the OBC/Clock Connector.

If your OBC does not function when you turn on the ignition, start by checking for power at the connector. Pins 6, 8, 9, and 17 should carry +12v (see table 2 & fig 3 for pin functions) and as mentioned above pin 17 will most likely be the one with no power. With no power at pin17, the OBC will play completely dead.

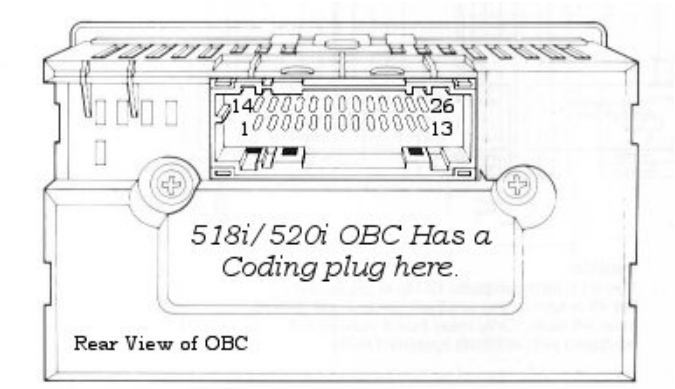
Table 2	**OBC Connector Assignment**		
Connector Ref. X501			
Pin No.	**Function**	**Wire Colour**	**Input/Output**
Pin 1	Alarm/Hood Switch	Violet/Green/Yellow	Input
Pin 2	TXD to Instrument Cluster	Blue/Brown/Yellow	Output
Pin 3	Diagnostics Connector RXD	White/Yellow	Input
Pin 4	Terminal 31 Ground	Brown/Orange	Input
Pin 5	Temperature Sensor	Blue/Red/Yellow	Input
Pin 6	Terminal 15 +12v from fuse F17 (7.5A)	Green/Red	Input
Pin 7	Instrument Cluster Speedo Output	Black/White	Input
Pin 8	Terminal R +12v from fuse F1 (15A)	Violet/Yellow	Input
Pin 9	Terminal 30 +12v from fuse F20 (10A)	Red/Yellow	Input
Pin 10	Terminal 50 Starter Motor	Black/Green	Input
Pin 11	Terminal 11 ECU	White/Black	Input
Pin 12	Fuel Tank Sender	Brown/Violet	Input
Pin 13	Reserved		
Pin 14	Instrument Cluster	White/Grey	Input
Pin 15	RXD from Instrument Cluster	White/Brown	Input
Pin 16	Diagnostics Connector TXD	White/Violet	Output
Pin 17	+12v BC 30S - DWA/Relay box See note 1	Red/Grey/Yellow	Input
Pin 18	Gong T2 See note 2	White/Blue	Output
Pin 19	Gong T1 See note 2	White/Red	Output
Pin 20	Independent Heater	Black/Red/Yellow	Output
Pin 21	Independent Ventilation	Black/White/Yellow	Output
Pin 22	Light switch	Grey/Red	Input
Pin 23	Horn – DWA/Relay box See table 2	Violet/White/Yellow	Output
Pin 24	ECU – Code blocking	Black/Violet	Output
Pin 25	Remote Control See Note 3	Yellow/Red	Input
Pin 26	Fuel Tank Sender warning signal	Black/Red/Yellow	Input

Notes: -

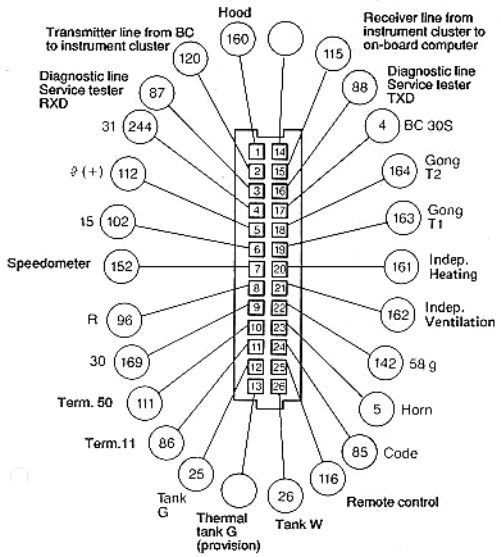
1. The DWA/Relay Box (alarm system/aux horn relay) units are located under rear left seat power distribution box if fitted.
2. The gong will only be fitted if your car has the multi-functional digital clock or check control system/s.
3. The OBC Remote control function will only work if you have purchased the indicator switch with the OBC remote button built in.

T1 = Hour signal, T2 = Speed signal, ECU = Engine control unit, DWA = F/F Alarm, TXD = Transmit data, RXD = Receive data

(Fig. 2) OBC



(Fig. 3) OBC Connector X501



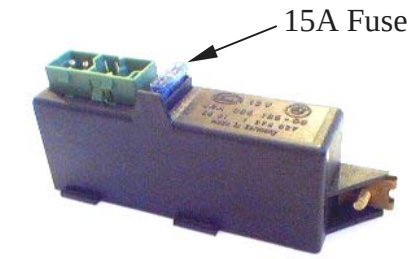
If you find that power is missing from pin 17 here is what you can do. An easy solution is to cut the red-grey-yellow wire that goes to pin 17, try to cut it as far from the connector as possible to make life easier. Join this wire to the red-yellow wire (red with yellow strip) that goes to pin 9.

CAUTION; There's also a yellow wire with a red stripe that goes to pin 25! Although not a critical wire, it does mean the OBC remote function will not work if cut, also if this wire is connect to pin 9 the OBC may be **Permanently Damaged!**

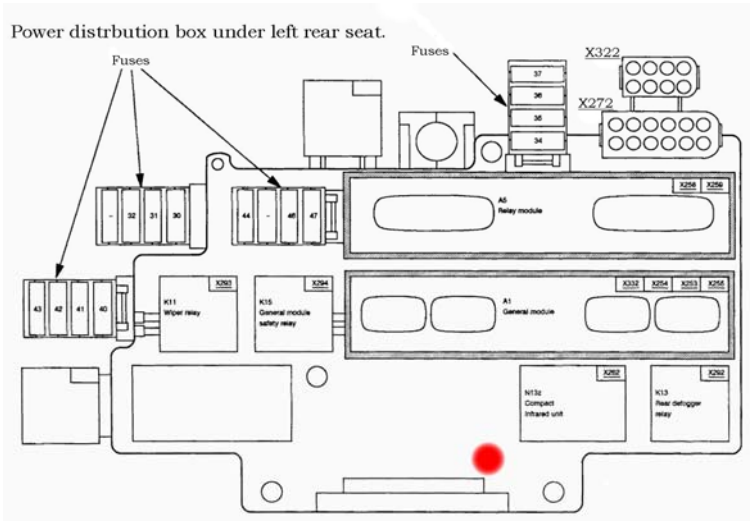
Pins 17 and pin 9 should be connected together via a 15A fuse (this is the value of the fuse fitted to the DWA/Aux Horn Relay). It would also do no harm to tape off the other end of the red-grey-yellow that has just been cut to avoid any problems in the future.

The author's recommended way however of connecting pin17 to pin 9 is to purchase an auxiliary horn relay, shown below in fig 4. This can be fitted in place by the power distribution box under the left rear seat, shown in fig 5.

(Fig. 4) Aux Relay



(Fig. 5) Power Distribution Box



To gain access to the aux horn relay connector (designated by BMW as X335) you will need to unscrew and pull out of the way the power distribution box. The red dot in fig 5 above shows approximately, where X335 is located under the power box. Table 3 below shows the pin assignments for this connector.

Table 3	**Horn Relay Connector Assignment**		
Connector Ref. X335			
Pin No.	**Function**	**Wire Colour**	**Input/Output**
Pin 1	Antitheft horn See note 2	Black/Blue	Output
Pin 2	+12v BC 30S to OBC and DWA See note 1	Red/Grey/Yellow	Output
Pin 3	Horn trigger from OBC	Violet/White/Yellow	Input
Pin 4	Terminal SOU (battery)	Red	Input

Notes: -

1. This is the other end of the wire from connector X501 (OBC), if you don't want to purchase the horn relay from BMW (P/N 65 81 1 378 027) you can join pin 2 to pin 4 via a 15A fuse, using scotch lock connectors. This, the authors recommends, as being the better way of getting your OBC to work.
2. If your feeling adventurous you could trace this wire back to under the bonnet and attach a horn to it. If the connector is not fitted (and it probably won't be) or you cannot find the wire in the loom (big job!), running a wire from under the bonnet back to X335 is a relatively easy task. Use scotch locks to attach to the wire coming from pin 1. Fitting a horn will enable the CODE function of the OBC to make noise if an incorrect CODE is entered. **You will need the horn relay for this to function.**

Step Three – Installing the OBC.

Hope fully you now have a working OBC hanging from your dashboard, so the next step is to fit it properly. You can replace the old mounting frame with the correct one (see table 1 above for the BMW part numbers), or as mentioned earlier you can cut away the back of the existing frame. Either way works, though the best solution is to replace the frame. This takes a little longer to do but the OBC will be fitted properly.

Step Four – Setting up the OBC.

Having got this far with the installation, and the OBC neatly fitted to the dashboard your car, you will need to setup and calibrate (if necessary) your OBC, first task is to set the country setting for language, miles/km, C/F and l/100Km / Km/l.

To do this you will need to gain access the OBC test menu, this is done by simultaneously pressing the 1000 key and the 10 key. The OBC should then display the word "TEST". Using the 10 and 1 keys enter 11 on the display and press the S/R button. The current country setting will now be displayed; table 4 lists all the country options, as they should appear.

You can now use the 1000 and 100 keys to alter the country, and use the S/R key to save.

Table 4				**OBC Options**
Test 11 - Country selection				
1. LA-J	3. LA-F	5. LA-I	7. LA-UK	9. LA-US
2. LA-CAN	4. LA-E	6. LA-CH	8. LA-D	10. LA-FCH

After using the OBC for a while it should become apparent whether or not it gives accurate readings for fuel consumption. This measurement can be calibrated using an extended function of the OBC, Function 20. Firstly, fill up your fuel tank to the brim (so you can see the petrol in the filler neck) then reset the trip counter and one of the OBC's average fuel consumption monitors.

Run the fuel tank until nearly empty (the yellow light just flickering) and then refill the fuel tank, once again to the brim. The amount of fuel it takes to fill the tank the second time is the amount used to cover the mileage recorded on the trip meter so, from this, work out the actual fuel consumption of your car (see note1 below). Compare the result to what the OBC reported as average fuel consumption. If these two consumption figures do not match exactly then you need to calibrate the OBC by entering a new correction factor.

To enter a new correction factor for fuel consumption access the "TEST" menu once again by simultaneously pressing the 1000 and 10 keys. With the 10 and 1 keys enter 20 and then press the S/R button, **CAUTION; Do Not Enter 21 and press the S/R button, as this will reset your OBC.** The display should now read "1000 CORR" or something like, this is your current correction factor. The new correction factor is calculated with the following equation:

New correction value = Old correction value * Actual MPG / OBC MPG

Enter the new correction factor into the OBC with the 1000/100/10/1 keys and press the S/R button.

Note: -

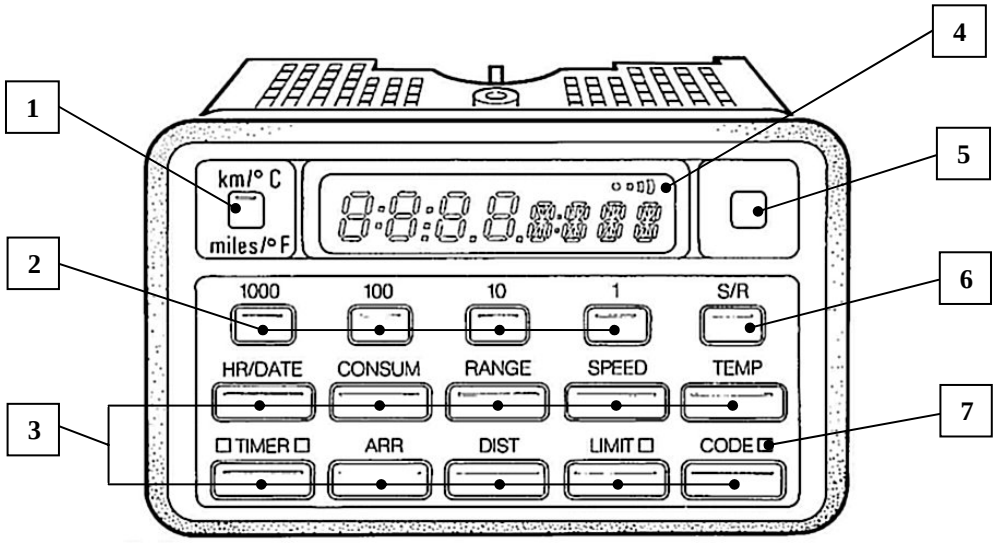
1. The author's E34 has an 80ltr fuel tank (17.6 UK gallons). On a long journey it will do about 420 miles to a tank full of fuel, therefore the average fuel consumption of the author's car is: - 23.9 miles per gallon. That is 420 / 17.6 = 23.9.

Schematic diagrams for the OBC can be found in the schematics section.

- OBC IV Operation & Hidden Functions

This next section covers the operation of the OBC and it's hidden functions. Much of the content of this comes from two sources: - The BMW E34 Owner's Handbook and a manual that covers the OBC III, OBC IV, Time Switch/Clock and Multifunctional Time Switch/Clock.

OBC IV Operation



1. Unit of measurement change
2. Number input keys
3. Information function keys
4. Digital display
5. Automatic display brightness sensor
6. Start-Stop (SET/RESET) key
7. Light-emitting diodes (LEDs)

The on-board computer (OBC) can supply the following information outputs to the user: -

- HR/DATE - Time or date
- CONSUM - 2 average fuel consumption readings
- RANGE - Range on remaining Fuel
- SPEED - Average speed
- TEMP - Outside temperature
- TIMER - Stopwatch and 2 switch on times for independent heater/ventilation system
- ARR - Estimated time of arrival
- DIST - Distance from destination
- LIMIT - Speed limit warning
- CODE - Immobilisation of car

The computer is ready for use with the ignition key at position 1 and beyond. **CAUTION:** for road-safety reasons, only input information before a journey or with the car standing still.

Pressing the appropriate information key will obtain the following display (no other input is necessary):

- Average speed
- Average fuel consumptions 1 and 2
- Range on remaining fuel
- Outside temperature

After pressing one of the information buttons:

- Average speed
- Average fuel consumptions 1 and 2
- Stopwatch (with independent heater/ventilation if installed)

Pressing the S/R button (6) will start or stop the computer.

Numerical inputs for:

- Time/date
- Speed limit warning
- Switch-on times 1 and 2 for independent fuel-burning heater/ventilation system
- Distance from destination (used to estimate time of arrival)
- Immobilisation of car

Are described in Table 4.

After selecting the appropriate information key, the unit measurement changeover key (1) can be used to display any individual item of information (except the CODE function) in either metric or imperial units.

Remote control

If the turn indicator lever is pushed in briefly: Information is displayed additionally on the check control display if fitted, items can be called up in succession. The OBC display remains unchanged when other items of more importance are shown on the check control display.
Note the display of check control warnings will take priority over information from the OBC.

To erase the check control display, press the check control button on the instrument panel or the CODE key.

If only a limited amount of information is required on CC display, proceed as follows:

- Press the turn indicator lever in for 3 seconds, until PROG 1 is displayed (P1 on the OBC)
- Press the desired information keys (if only average fuel consumption 2 but not average fuel consumption 1 is required, press the units of measure key (1) after the CONSUM key. Each time the changeover key is pressed again, fuel consumption readings 1 and 2 will alternate. The same procedure applies to the date and switch on time 2 inputs.)
- Press the S/R key.

If you wish to have all the information available for display again on the CC display, proceed as follows:

- Press the turn indicator lever in for 3 seconds; the PROG 1 display will appear (P1 on the OBC)
- Press the S/R key.

Changing the car battery and the OBC

If the power supply to the OBC is interrupted, e.g. when changing the battery, all stored data will be erased.

Once power is restored, the required information data (time, date, speed limit warning and switch-on time if required) must be input again.

If PPPP should appear on the display, your OBC may have developed a fault. Contact BMW or another expert for help.

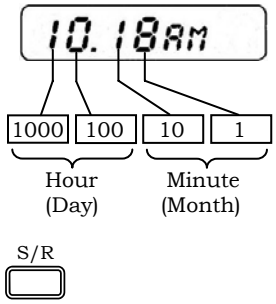
Table 5 Computer data input and information displays

Important: input sequence for numbers: 1000 100 10 1

The memory will not accept illogical inputs.

When a number is input, the current number stored in the memory is erased; digits can be altered individually in any order. The appropriate numerical display increases by one each time a key is pressed or every half-second if the key is held in.

To input to memory: press the S/R button

Function	**Input:** *press keys in the sequence illustrated*	**Info. Display:** *if an unwanted output is displayed, press approp. Information key*	**Notes:** *on input and information display. CC = Check Control in the instrument cluster*
Time (Date)	HR/Date  S/R	HR/Date	If display is ____ HOUR (after power failure), input time again. Clock can be started after input to the nearest second by pressing the S/R key (E.g. by using a watch). Date input as for time. After pressing the S/R key, the year is displayed. Input the correct year and press the S/R key again. To obtain date display from other information: press HR-DATE key twice. To correct the time or date display, alter the numerals and then press the S/R key. Hourly signal: in HOUR function, press S/R key; a sound wave symbol is displayed. Three pips are heard just before each full hour. The time is displayed briefly on the CC display. To switch off hourly signal: in the HOUR function, press S/R again. To obtain time and date display in ignition key position 0: press the HR-DATE key.
Average Consumptions 1 and 2	CONSUM S/R	CONSUM	Recalculated since start of journey when S/R key is pressed. Repeated use of the CONSUM key selects average consumption values 1 and 2 alternately; indication of which consumption value has been selected appears on the display for a short time.
Range	—	RANGE	Plus sign (+) in front of display indicates “full tank”.
Average speed	SPEED S/R	SPEED	Recalculated from start of journey when S/R key is pressed.
Outside temperature	—	TEMP	Automatic temperature display below +3°C (37.5°F). Gong sounds and unit of measurement flashes for 8 seconds. The temperature value is displayed briefly on the CC display.
Stopwatch — Start	□TIMER□ → S/R	—	There is no stopwatch function in cars with an independent fuel-burning heater/ventilation system. When the stopwatch function is running, the LED lights up.
— Intermediate time	—	□TIMER□	LED flashes, stopwatch continues to run. Press the TIMER key again: the running stopwatch display will reappear.
— Stop	□TIMER□ → S/R	—	To stop the stopwatch when another display is shown. Otherwise, simply press S/R. Press S/R again to restart the stopwatch.
Independent heater/ ventilation system — Direct switch-on	□TIMER□ → S/R	—	When the TIMER key is pressed, the current inputs to the independent heater/ventilation system are displayed. Direct heater operation in ignition key position 1. Switching off also possible in key position 0. In the TIMER function, press S/R key only.
— Direct switch-off	□TIMER□ → S/R	—	

Function	**Input:** *press keys in the sequence illustrated*	**Info. Display:** *if an unwanted output is displayed, press approp. Information key*	**Notes:** *on input and information display. CC = Check Control in the instrument cluster*
– Preselecting switch-on times 1 or 2	☐TIMER☐ ☐TIMER☐ 1000 100 10 1 S/R	☐TIMER☐ ☐TIMER☐	Input is possible only when the clock is in operation. With the TIMER function selected, press the key once only; for switch-on time 2, press it again (confirmed on display). When the LED comes on, the heater/ventilation system will run for 30 minutes from selected switch-on time. During the actual period of operation, the LED flashes. It goes out when the system is switched off. To correct the switch-on time, follow the same procedure as for initial inputs. After selecting the switch-on time inputs 1 or 2, activate or de-activate the timer by pressing the S/R key. When activated, the appropriate LED comes on.
Distance to destination	DIST 1000 100 10 1 S/R	DIST	If the preset distance is exceeded, the additional distance is still counted, but preceded by a minus sign.
Estimated time Of arrival	–	ARR	The probable arrival time based on distance input is continuously recalculated according to driving style at any given moment. This information is only available after a distance has previously been input. If the distance has already been completed, the DIST function appears instead of the ARR function. If selected from another function, _ _ _ _ ARR is displayed
Speed limit warning	LIMIT ☐ 100 10 1 S/R	LIMIT ☐	If the input speed limit is exceeded, the LED flashes and a gong sounds. The limit value appears briefly on the CC display. Press the LIMIT key again to switch off the speed limit warning: the LED will go out, but the speed value in memory is retained. To store the speed at any given moment in the memory: in the LIMIT function, press the S/R key.
Code to immobilise car – to activate	Ignition key in position 1 CODE☐ 1000 100 10 1 S/R	–	Code numbers from 0000 to 9999 can be input. **Important: memorise the code number!** Ignition key turned to 0: LED comes on for up to 36 hours.
– to de-activate	Ignition key at position 1 or 2 1000 100 10 1 (Input code) S/R or start engine	–	**Warning:** **if 3 incorrect inputs are made consecutively, or 3 attempts are made to start the engine, an alarm sound for 30 seconds.**

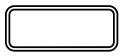
Note: Changes in information programs are only possible after pressing the relevant information key.

Further information on the OCB

HR/DATE

The time and date are displayed alternately by pressing the key. The date display disregards leap years and must be corrected manually as appropriate.

CONSUM

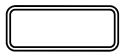


By giving the instruction to restart the calculation at a carefully selected moment, average consumption for the entire journey and for part of the journey can for instance be calculated at the same time.

RANGE

By pressing this key, the estimated distance which can still be covered with the fuel remaining in the tank is computed continuously according to driving style and displayed when selected. Below a range of 15 km (9.3 miles), a flashing four-segment display indicates that more fuel is urgently required.
The OBC only registers the addition of fuel in ignition key positions 1 and 0, and when at least 5 litres of fuel are added. A plus sign (+) before the display indicates that the car has greater range than indicated, because of limits in recording fuel level in the tank.

TEMP



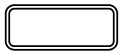
The warning gong sounds again if the temperature has increased to +6° C (43° F) at least once since the last warning signal, then dropped below +3° C (37.5°F) again . Note that the absence of a low-temperature warning does not mean that ice may not have formed at a temperature above +3° C (37.5° F), for example on bridges or in shaded areas.

□TIMER□

The maximum time which can be measured is 99 hours 59 minutes. The time display shows seconds and tenths of a second for the first minute, then minutes and seconds, and hours and minutes after the first hour. The stopwatch is halted when the ignition key is turned to position 0, and restarts when it is turned to position 1 or beyond.

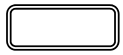
Independent heater/ventilation system:
If the key is pressed again when other information is being displayed, the following information can be obtained in succession: current situation, switch-on time 2, current situation again etc.

LIMIT□



A new speed limit value can be input or displayed.
The gong will sound again if the car has slowed down by 5km/h or more at least once since the gong first sounded and then been accelerated up to the input speed limit again.

CODE □



When the system has been activated, the engine compartment lid, radio and any attempt to start the engine are monitored.
If the engine compartment is not properly closed or the radio is removed, the LED flashes for 10 seconds when the ignition key is turned to 0.

If the ignition key is turned to 1 or 2 with the system activated, the gong will sound and the OCB will display _ _ _ _CODE. This requires the code to be input. If the engine is started and a code input has not been made, a warning gong sounds continuously.

Emergency starting procedure if code has been forgotten:
— Disconnect and (after approx. 5 minutes) reconnect the battery.
— Turn the ignition key to position 1; the alarm will sound.
— A time display will appear and run down to zero for 15 minutes.
— After 15 minutes, the engine can be started.

During the waiting period of 15 minutes, the code can be entered again:
— Press the CODE key
— Input the desired code
— Press the S/R key
— Start the engine.

The above text on the operation of the OBC has been taken from the E34 Owner's Handbook.

OBC Hidden Functions

The OBC has two hidden key combinations to access the extended functions: when number keys 100 and 1 are pressed simultaneously the OBC displays the car version number, the first digit is the cars model number, and the second the next two digits are related to the cars version. E.g. 5-05 TYP

When number keys 1000 and 10 are pressed simultaneously access to the OBC's test menu and the extended functions is granted.

The OBC also has two modes of operation: LOCKED mode and UNLOCKED mode.

Locked mode
In this mode, you can access all the normal functions of the OBC plus five higher functions (functions 1, 10, 11, 19 and 20) from the "TEST" menu, one of which allows the user to unlock the OBC (extended function 19). Trying to enter any other test will return to the time display.

Unlocked mode
In this mode, all normal functions and all the extended functions are available. Twenty-one extended functions are available. These functions are included for use by a BMW service centre, however some can be quite useful to the vehicles owner. Table 6 describes all the OBC's extended functions and how to unlock them, see function 19 and note 6.

Whether you have retrofitted an OBC to your car or your car was already fitted with the OBC, it will most likely be running in locked mode. To gain access to all the extended functions the OBC must first be unlocked. The date must be set before the OBC can be unlocked.

Table 6				**OBC Extended Functions**
BMW Ref. OBC Service Functions				
Test No.	**Function Description**	**Displayed Info. Example**	**Display Type**	**Manipulation**
1	Display Test (lamp test)	8888 ✱✱✱✱	Fixed	None
2	Present fuel consumption (litres/100km)	14.5 VBR	Variable	Measurement
3	Present fuel consumption (litres/hr)	24.6 L/H	Variable	Measurement
4	Average fuel consumption (litres/100km) (Used to calculate range)	13.2 TVBR	Variable	Calculation from measurement
5	Current range (km) undamped	487 RW	Variable	Calculation from measurement
6	Tank volume (litres)	63.5 T:ADC	Variable	Measurement
7	Tank volume determined (litres)	62.5 T:MTL	Variable	Measurement
8	Present road speed (km/h)	83.4 V	Variable	Measurement
9	Operating voltage terminal 15 (V)	12.75 UB	Variable	Measurement
10	Speedometer correction/calibration	0.97 EICH	Setting	See note 1
11	Country select	LA-UK	Setting	See note 2
12	Average road speed for arrival time	69.5 VANK	Variable	Calculation from measurement
13	Arrival time undamped	15.36 ZANK	Variable	Calculation from measurement
14	OBC Firmware (program) date	27.06. 1988	Fixed	None
15	Fault memory diagnosis (hexadecimal)	05.C5 DIAG	Fixed	See note 3
16	Input/output port values (hexadecimal)	07.AF PORT	Variable	See note 4
17	Car specific data (hexadecimal)	06.50 PROM	Fixed	See note 5
18	Change horn output Interval/continuous (DTON or ITON respectively)	HUPE. DTON	Setting	C/F selects S/R to Save
19	Unlocking/locking OBC test functions (LOCK or FREI)	LOCK	Setting	See note 6
20	Fuel consumption correction value	1000 CORR	Setting	See note 7

Test No.	Function Description	Displayed Info. Example	Display Type	Manipulation
21	OBC reset **CAUTION:** resets date, time and fault codes. PROM values not reset.	PPPP	Action	S/R to activate

*The test numbers in **bold** above can be accessed in locked or unlocked mode*

Notes: -

1. The speedometer in the instrument panel can be calibrated from the OBC. Function 10 is used for this purpose. You will require a stopwatch and long flat road with mile or km marks (a rolling road could also be used). Keep a constant speed of about 60 mph or 100 km on the speedometer. Using the stopwatch measure the time it takes to drive either 2 m or 2 km. Use the following equation to work out actual speed. This function may not work on all cars.

   Actual speed = Actual Distance (in miles or km) / Time (in seconds) /0.36

   New correction value = Old correction value x Actual speed / Speedometer reading

   Enter the new correction factor into the OBC with the 1000/100/10/1 keys and press the S/R button to save.

2. The options for country selection are given in the table below in the order they are displayed on the OBC.

Test 11 - Country selection				
1. LA-J	3. LA-F	5. LA-I	7. LA-UK	9. LA-US
2. LA-CAN	4. LA-E	6. LA-CH	8. LA-D	10. LA-FCH

3. OBC diagnostic values given in hexadecimal. There are nine values that can be displayed, use the 1000 and 100 keys (up/down respectively) to scroll through the values. The displayed values cannot be changed or saved. The values for the author's car are listed below.

Test 15 – Fault memory diagnostic values				**examples**
01. 51	03. 56	05. C5	07. A7	09. 0D
02. 52	04. 04	06. C6	08. 60	

4. The input and output ports of the OBC are monitored continuously and displayed in hexadecimal. There are nine values that can be displayed, use the 1000 and 100 keys (up/down respectively) to scroll through the values. The displayed values cannot be changed or saved. The table below shows the data from the author's car.

Test 16 – Input/output port values (engine off)				**examples**
01. AF	03. 00	05. 12	07. AF	09. 00
02. 00	04. 1F	06. 90	08. 7F	

5. Car specific data is held on a PROM (programmable read only memory) that the OBC can read. The data displayed relates to the setup of the car, what factory options were fitted etc. and the data is displayed in hexadecimal. There are nineteen values in all, to scroll through the values, use the 1000 and 100 keys (up/down respectively). The table below shows the data from the author's car.

Test 17 – Car specific data				**examples**
00. 4F	02. 00	04. 98	06. 50	08. 10
01. 00	03. 00	05. 78	07. 35	09. 12
0A. 63	0B. AF	0C. C6	0D. EA	0E. 29
0F. F9	10. C6	11. 45	12. 00	13. 00

6. Unlocking the OBC: Press the HR/DATE button until the date is displayed and note the date e.g. 08.19 DATE. Next access the test menu by pressing the 1000 and 10 keys, the OBC will show the word "TEST". Using the 10 and 1 keys enter 19 on the display and press the S/R button. The display should now read "LOCK". Add the day and month (as noted earlier) and enter this value, e.g., 08 +19 equals 27, and then press the S/R button. The OBC display should now read "FREI", the OBC is now unlocked. To lock the OBC again, enter function 19 and press the C/R button.

7. To enter a new correction factor for fuel consumption access the "TEST" menu by pressing the 1000 and 10 keys. With the 10 and 1 keys enter 20 and then press the S/R button, the display should now read "1000 CORR" or something like, this is your current correction factor. The new correction factor is calculated with the following equation:

   New correction value = Old correction value * Actual MPG / OBC MPG

   Enter the new correction factor into the OBC with the 1000/100/10/1 keys and press the S/R button to save.

8. Test functions 15, 16, and 17: These values are only meaningful to a BMW service centre, if the information becomes available on what these values mean they will be listed here.

- Instrument Cluster (High)

There are two types of instrument cluster fitted to the E34 range, the “low” cluster and the “high” cluster. The low cluster is the more basic of the two with a digital display for mileage and service inspection lights at the bottom of the speedometer dial and an automatic gearbox selector lever position indicator in the middle of the telltale lights at the bottom of the cluster.

The high cluster has a digital display at the bottom of the cluster, with check control, service indicator, mileage and selector lever position indicator displays above, below, left and right respectively. As well as the trip counter rest button there is also another button next to the temperature gauge; this is the check control button.

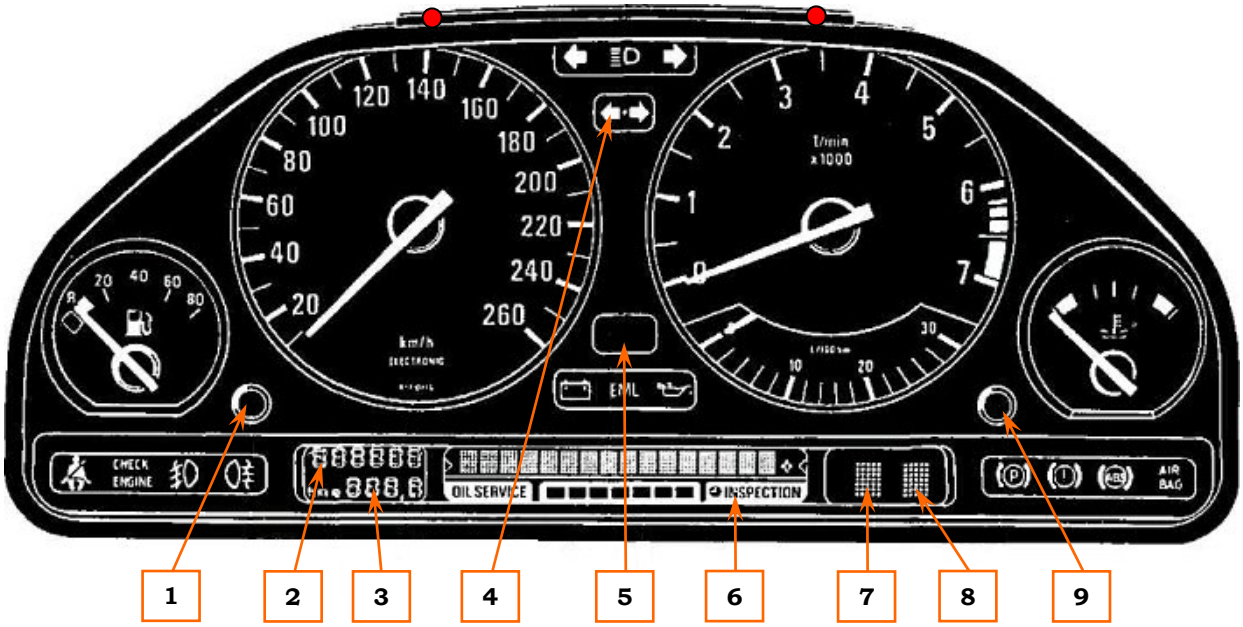
The following text will deal with the “high” cluster only. It is not intended to be a complete breakdown of how the cluster works, just some of the basics. Design and brief description, functional description, coding plug, check control “CC” function, removing the cluster, test and repair (inc. bulb replacement), connector pinouts, fuse and relay details (as this is in the BMW book on the instrument cluster), newer cluster versions and finally some schematics.

Design and brief description

The “high” instrument cluster as fitted to the E34 range of vehicles was first used in BMW’s E32 range. It is of modular design (see fig. 8 below) making the replacement of faulty components a simple task with locking connectors for more reliable operation.

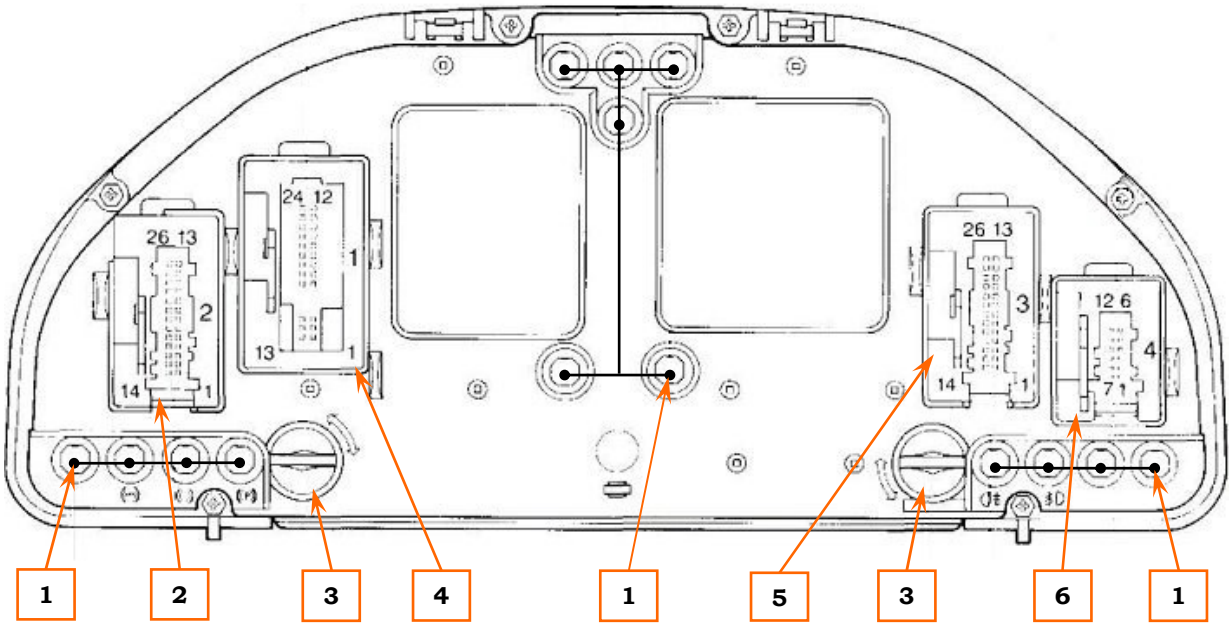
The various functions of the cluster are realised with the help of a complex electronic circuit. The speedometer, tachometer, fuel gauge, temperature gauge and economy control are all activated and evaluated electronically and in addition incorporates the check control function, with LC digital displays being employed.

(Fig. 6) High Cluster Layout Front



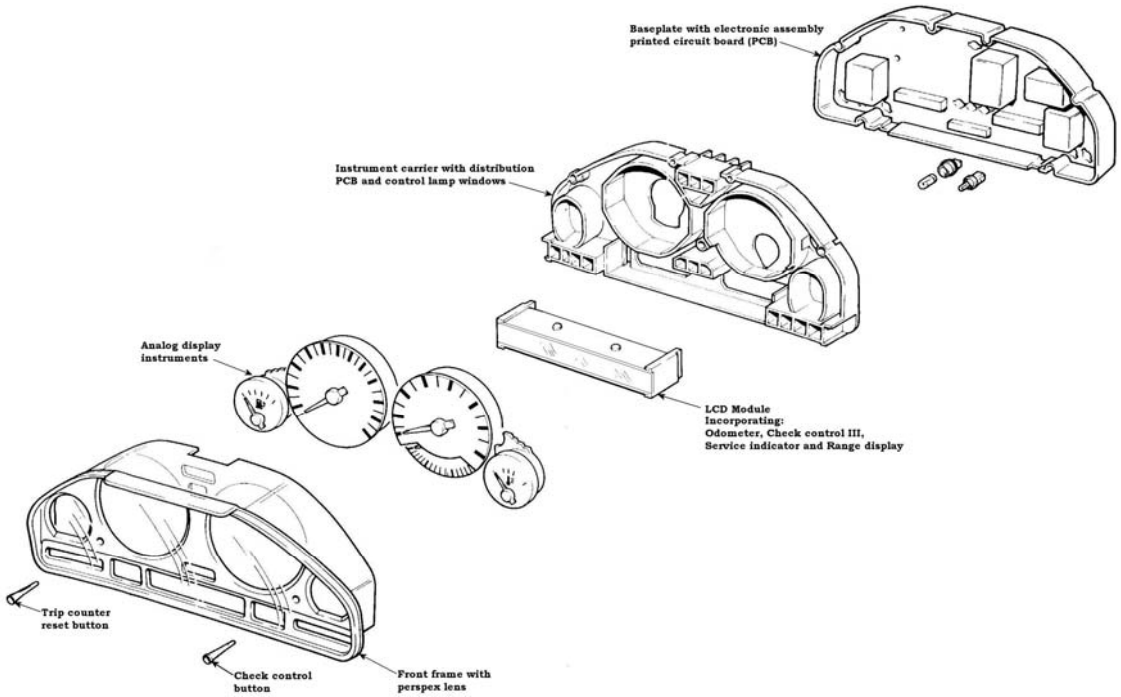
1. Daily trip recorder reset button
2. Odometer display
3. Daily trip recorder display
4. Caravan turn signal indicator (only works with a factory tow bar)
5. Phototransistor
6. Check control and Service indicator display
7. Program display (only functions with a switch able automatic transmission)
8. Range display (only functions with a switch able automatic transmission)
9. Check control “CC” button

(Fig. 7) High Cluster Layout Rear



1. Light bulbs
2. Front wire harness section (beige)
3. T-screws
4. Coding plug connection (brown)
5. Instrument wire harness section (white)
6. Rear wire harness section (silver-grey)

(Fig. 8) Modular Design



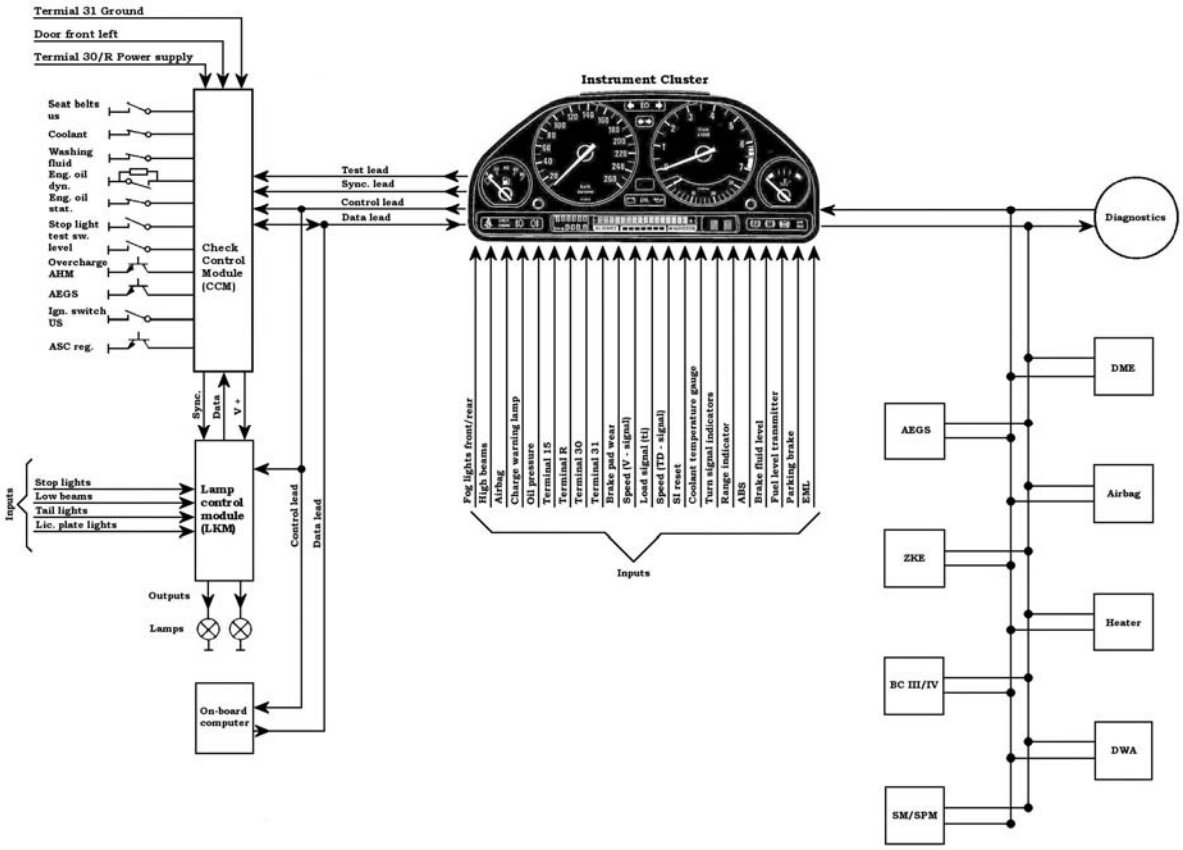
The instrument cluster is capable of exchanging data with other electronic units in the car via a serial data bus. A coding plug fitted to the back of the instrument cluster is employed to store operating data and car model data.

In fig's 6 and 7 above the actual layout of your instrument cluster may differ slightly from the pictures shown, this is dependant on the year of manufacture and the country the vehicle was originally intended for. Also cluster's made beyond late 89 (new version) are not covered.

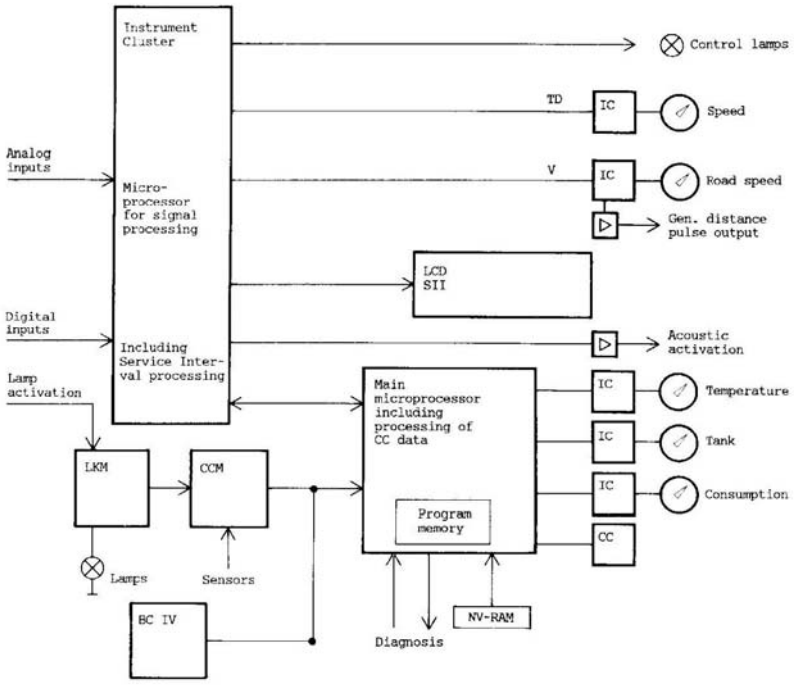
Functional survey

Various signals both analog and digital are fed into the instrument cluster where they are processed by a microprocessor and then output to the displays or instruments, different lamps are activated via switches. In fig's 9 and 10 functional survey and data flow diagrams are given. Inputs to the check control system are processed by another microprocessor and the messages stored in memory.

(Fig. 9) Functional Survey



(Fig. 10) Data Flow Block Diagram



The coding plug

The coding plug is located at the back of the instrument cluster in a housing, which is secured with a service cap (standard colour: brown) and permanently connected to a wire harness.

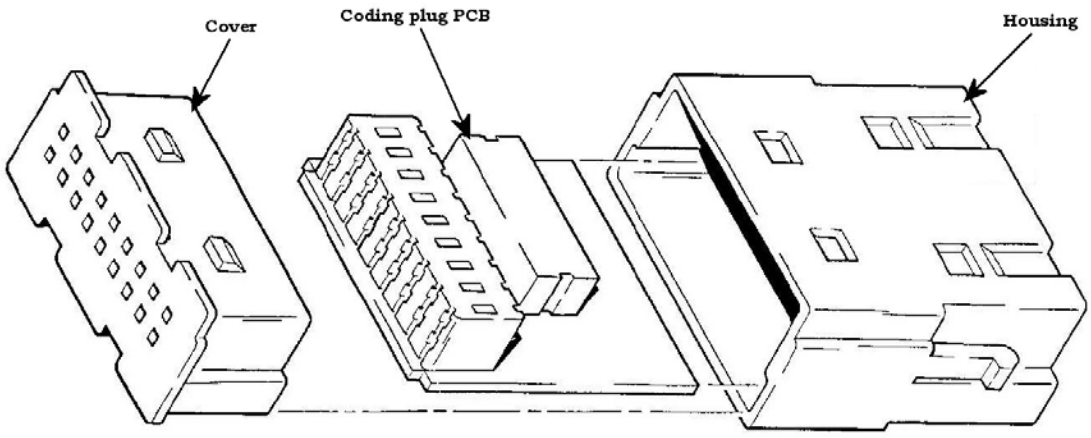
The coding plug is basically a non-volatile random access memory or NV-Ram for short which stores specific model and country data as well as data variables, such as for example total recorded mileage. A list of the stored data is given in table 7 below and fig. 11 below shows the coding plug and housing.

Table 7			**NV-Ram Storage Data**
1	Total Distance km/miles	10	Limit speed
2	SI – status, SI – time, SI – limits	11	Sound/trigger version
3	Code number of coding plug	12	Spare space for chassis number
4	Consumption curve family	13	Number of cylinders
5	Distance pulse number	14	Program display blendout
6	US/ECE version CC III	15	Country language CC III
7	Tank/5 conn. points (ltr, disp. values)	16	Total km counter offset (odometer)
8	Coolant temp. display/conn. Points	17	Program constants
9	Coolant excess temperature limit		

If the car battery is disconnected for prolonged periods of time the NV-Ram will still retain its data.

Each coding plug has a stored code number, on which it is possible to recognize which coding data is programmed. To display this code number, the ignition must be turned off, the daily trip reset button pressed and held in then the ignition turned to position “R”. The code number is then displayed for as long as the button is pressed in. All other displays remain dark during this time. Everything is returned to the normal state after releasing the reset button and the trip counter is not changed.

(Fig. 11) Coding Plug and Housing

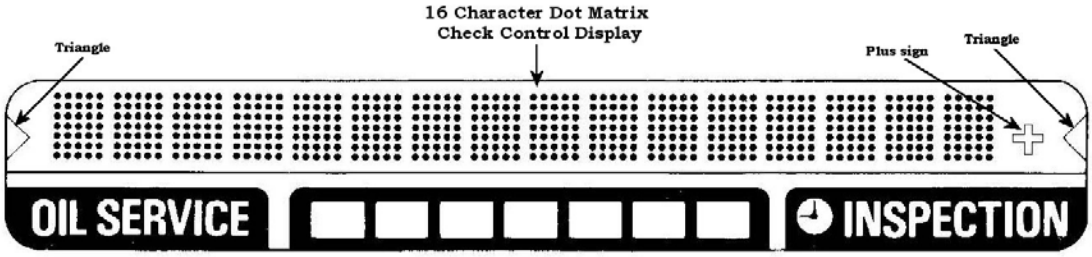


Check control “CC” function

The check control system is an active information system, which is capable of reporting on the state of important functions as well as giving warnings and useful information via an LCD dot matrix display (see fig.12) in view of the driver. It works together with other electrical units including; central body electronics (ZKE), on-board computer (BC IV), lamp control module (LKM) and other sensors. Functions are assigned to different priority groups 1 to 3 depending on their importance and displayed in text form when necessary e.g. Oil pressure has priority over washer fluid.

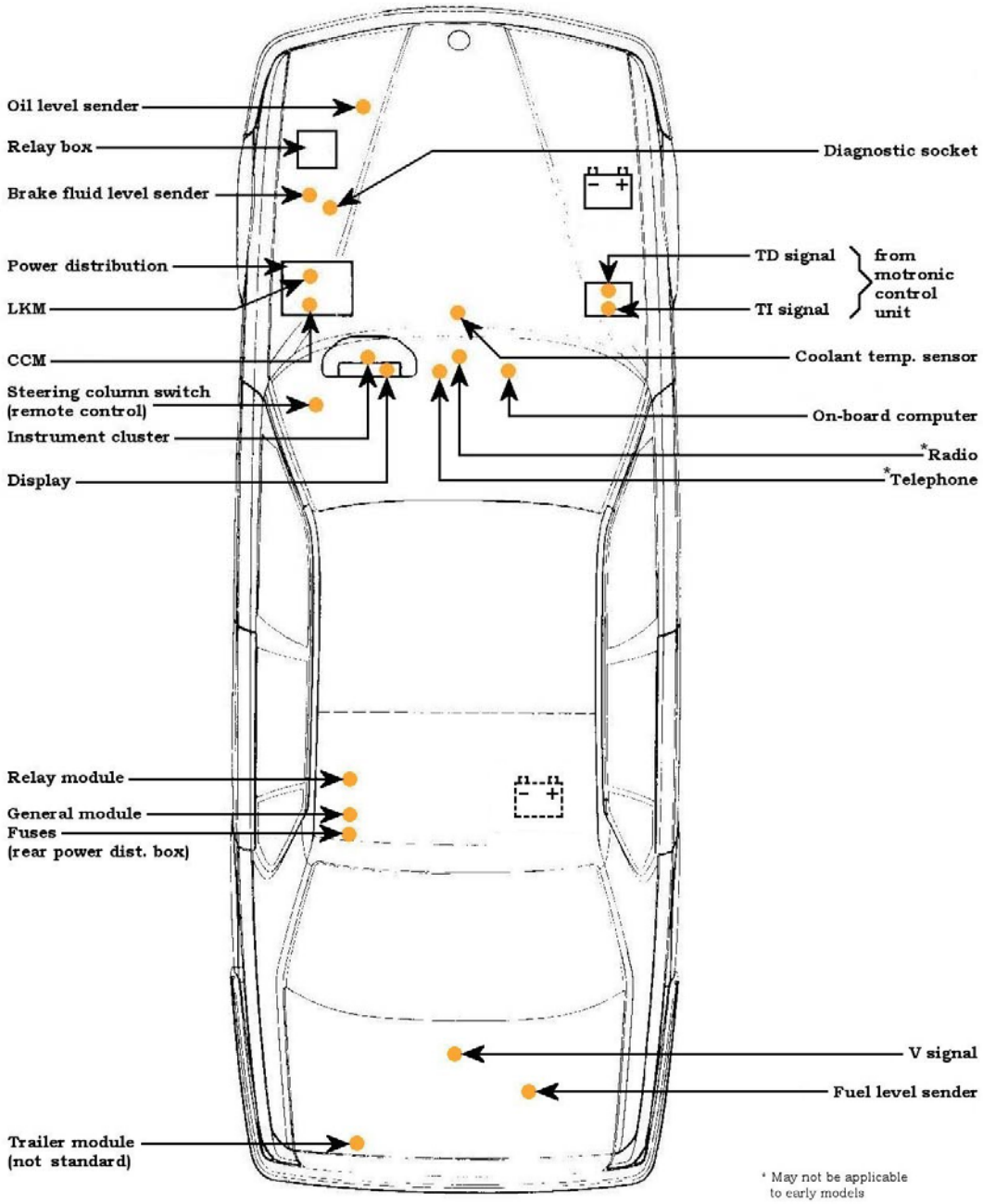
For warnings requiring urgent attention an audible sound in the form of a gong is heard, also the message on the display will flash. A + sign will appear when there is more than one defect.

(Fig. 12) Check Control Display



The check control system monitors the state of various sensors and control units in order to feed useful information to the driver on the state of the vehicle fig. 13 shows the CC layout.

(Fig. 13) Check Control System Layout



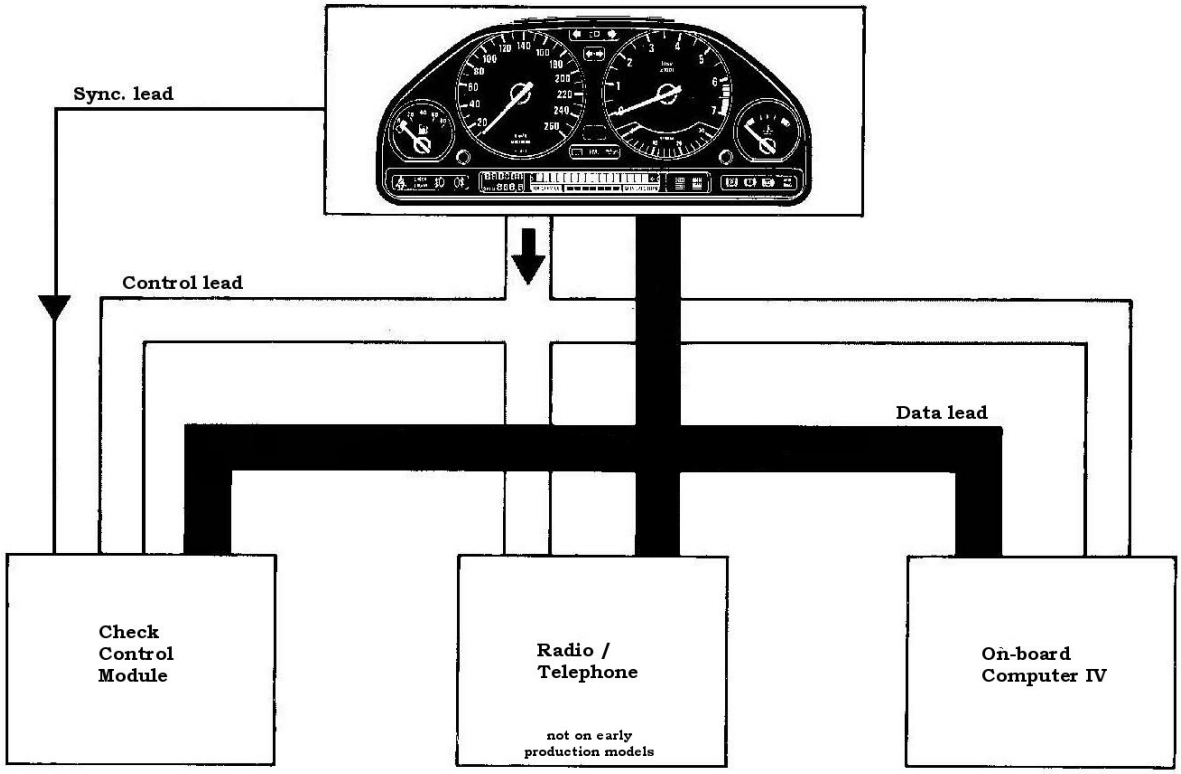
"CC" Data communication

The instrument cluster controls data communication. Sensor information from the check control module (CCM) and lamp control module (LKM) is sent in serial form to the instrument cluster via a serial interface. The serial interface is also used to transfer vehicle specific data to the on-board computer from the coding plug. Fig. 14 shows a data communication survey.

The display in the instrument cluster serves the check control and on-board computer for the display of information. Additional data communication lines were added to later models catering for factory fitted radio and telephone information to be sent to the display.

Check control has priority over the OBC (and in later models, radio and telephone) because of its important messages to the driver.

(Fig. 14) Data Communication Survey



Check control use

Fault displays of priority groups 2 and 3 can be cancelled (acknowledged) and viewed again with the CC button. If several faults occur simultaneously a plus sign will appear on the RH side of the CC display see fig. 12, the additional faults can be viewed with the CC button, beginning with the fault with the highest priority.

The language is stored in the coding plug (see table 7) and can be changed with the CC button, when the ignition switch is in position R and the CC button is pressed for at leased 10 seconds. The language is displayed on the CC display. The CC button must be pressed again for 10 seconds to select the next language. The display is cancelled by turning the ignition key to "ignition" or "0". The newly selected language is stored in the coding plug.

The On-board computer display can be transferred to the CC display with the remote control steering column switch in addition to being displayed on the BC display. All BC functions except the CODE function can be displayed. However check control information will always take priority.

Priority groups

There are three priority groups the check control system can display. Group 1 is the highest and require immediate attention and groups 2 and 3 require attention as soon as possible table 8 lists all of the displayed warnings and their priority group.

Table 8	**Check Control Priority Groups**	
Displayed Message	**Description**	**Priority group**
Brake fluid	Level too low	Group 1
Engine oil pressure	Too low	Group 1
Coolant temperature	Too high	Group 1
ASC	Regulating	Group 1
Ride level	Wheel camber – faulty	Group 1
Release parking brake	Applied while driving >10 km/h	Group 1
No stop lights	Failure of both lights	Group 1
Stop light electric	Stop light switch faulty	Group 1
Transmission	A.T electrics faulty	Group 2
ASC faulty	Failure	Group 2
Brake pads	Worn	Group 2
Stop lights	Failure of one light	Group 2
Low beams	Failure	Group 2
Tail lights	Failure	Group 2
Licence plate lights	Failure	Group 2
Trailer lights	Trailer module, fuse or lead	Group 2
Engine oil level	Too low	Group 3
Transmission oil level	ATF level too low	Group 3
Power steering oil level	Power steering oil level too low	Group 3
Check control	Check control module faulty	Group 3
Coolant level	Too low	Group 3
Washing fluid level	Washer fluid level reserve	Group 3
Oil pressure sensor	Oil pressure sensor or supply wire	Group 3
Oil level sensor	Engine oil level sensor	Group 3
Owners manual	Refer to owners manual	Group 3
U.S only messages		
No stop lights	Failure of 3 lights	Group 1
Fasten seat belts	-	Group 3
Ignition key	Remove ignition key	Group 3

Priority group 1

Messages with flashing triangle sign (see fig. 12) and continuous display: Includes faults that could result in the car being unsafe to drive. The text message is displayed immediately upon detection of fault.

A flashing triangle next to the text and a gong sound underline the importance of the displayed fault.

These faults cannot be cancelled with the CC button. If more than one fault is detected: The messages will be displayed in rotation (scrolling).

Priority group 2

Messages are displayed for 2 minutes: Includes faults that do not result in the car being unsafe to drive. Text messages are displayed with a simultaneous gong immediately after turning on the ignition.

These faults can be cancelled (acknowledged) with the CC button. A continuously displayed triangle sign tells the driver, that messages have been cancelled. Pressing the CC button will recall a fault message back to the display once again. Further pressing of the CC button, will display the next message.

Priority group 3

Messages displayed with the ignition "ON" or "OFF" – 20 second display with a stationary car: Includes reports concerning actual fluid levels and general information. A gong is activated with the ignition "ON" or "OFF". Messages are displayed when moving from ignition lock position and after stopping the car in ignition position "0".

After stopping the car messages can be recalled with the CC button for about 2 minutes.

No triangle sign is displayed after cancelling a fault, however if more than one fault occurs; the message with the highest priority and a plus sign will be displayed.

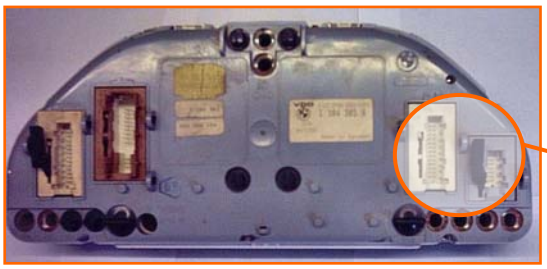
Removing the cluster

The instrument cluster is secured into the dashboard by two self tapping screws; fig. 6 above shows the approximate location of the two screws with a red dot.

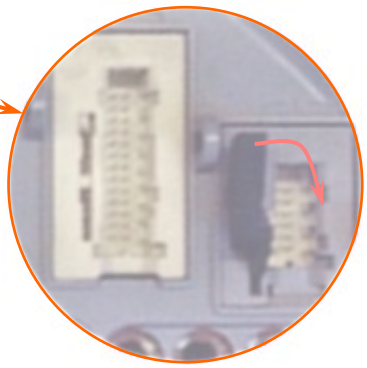
In order to remove the cluster (which can be done with the steering wheel in place); first undo these two screws, then using a flat plastic spatula or similar tool (to avoid damage to the dashboard) prise the instrument cluster from the dashboard by sliding the plastic tool between the top of the cluster and the dashboard. Pull the cluster out as far as you can being careful not to damage the face of your cluster (placing a soft cloth over the steering column will help prevent any damage).

There are four electrical connectors on the back of the cluster that now have to be removed, on each one there is a lever (see fig. 15 and 15a) lifting up the lever will pull the connector plug a little way from its socket. The connectors can then be removed the rest of the way by hand.

(Fig. 15) Cluster Connectors



(Fig 15a) The red arrow shows in which direction the lever should be pulled.



Once the connectors have been removed, the cluster can now be pulled clear of the dash toward the steering wheel. Now for the awkward bit: removing the cluster. As mentioned earlier this can be done with the steering wheel in place.

There are two ways of removing the cluster with the steering wheel in place. In the first, the steering wheel needs turning about 15 degrees left and the indicator switch needs pushing down. With a cloth covering the steering column carefully remove the instrument cluster by pulling it face down between the steering wheel and the dashboard. Some small amount of force may be required to get it passed the indicator switch (care required here hence the cloth over the steering column to prevent damage to the cluster), but it does go through the gap.

The second way is much simpler; the cluster will actually go through the steering wheel on some cars with very little effort, although the face of the cluster still needs protecting. The photo's that follow will show both methods of removing the instrument cluster.

(Fig. 16) Photographs of Cluster Removal.

Method 1

Method 2

Refitting the instrument cluster is simply a reversal of removing it. It ought to be mentioned that the cluster should be taken out of the dash by first removing the steering wheel, but this does take extra time and as the pictures above show is not really necessary.

Test and Repair

Testing and repair of the instrument cluster is very limited without the use of very expensive equipment. However there are a few things that can be done, testing is only possible with the use of the cluster's onboard diagnostic routine and repair is limited to fixing some erratic faults and replacing light bulbs.

The CC button mentioned previously has two other uses, setting the language for the CC display and running a self test: With the ignition key in Position II (radio and OBC on), pressing this button for about 20 seconds gives the next language. Pressing for another 20 seconds will move to the next language and so on (**ENGLISH-US**, **ENGLISH-UK**, **FRENCH**, **ITALIANO**, **ESPANGOL**, and **DEUTCH**). Note: Not all languages from OBC function 11 can be selected here and there is some interaction between setting the language this way and using the OBC.

Holding this button when turning the ignition key ON will perform an LCD lamp test on the instrument panel. This also shows some additional information: **BMWNr**, **CodeNr**, **K-Zahl**, **F.G.Nr**, **SWVersion**, **AndIndex**, **LcdTest**. The LCD Test has two steps: The first part of the test sets the fuel, economy and temperature gauges to full the speedometer reads 75mph (120 km/h) and the tachometer reads 3500rpm. The second part zeros the meters. Fig 17 shows an example of the test display.

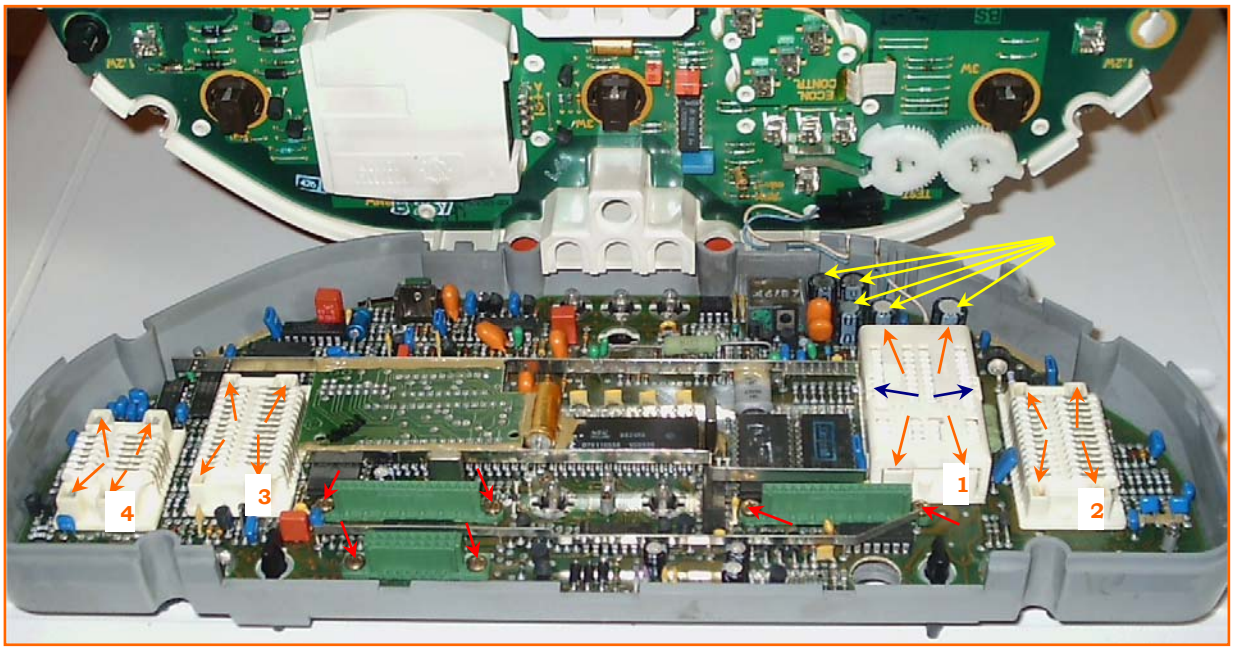
(Fig. 17) Instrument Cluster Test

The picture of fig 17 is showing the instrument cluster in the lamp test part of the onboard diagnostic routine. Note: the onboard diagnostic (lamp test) does not test the illumination of the clusters analogue instruments, front and rear fog light control lamps and the indicator control lamps as these can be activated by turning on the relevant light switch.

The onboard diagnostics is not really that useful to most people, but it can help to check the cluster if erratic behaviour is observed in operation. Should further information on testing the cluster and the meaning of the additional texts displayed, become available to the author it will be added to the end of this document.

Fixing the cluster is as limited as testing although replacing a few capacitors may fix some erratic problems though it's not guaranteed to work an all erratic faults. As an alternative to spending lots of money on a new cluster PCB it's worth a go.

(Fig. 18) Cluster PCB

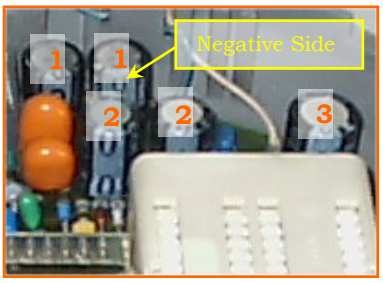


If the instrument cluster begins to malfunction with the following failure symptoms:-

- Temperature, fuel gauges and the LC display not working when cold.
- Erratic functioning of the cluster gauges and lights.

Then there are five electrolytic capacitors that require replacing, in fig.18 the yellow arrows show which capacitors fail. To remove these components the PCB must first be removed from the plastic casing. First open the instrument cluster by turning the T screws on the back, there should be arrows on the case to show which direction to turn them. Then remove the screws shown by the red arrows and keep them safe, next the orange arrows show where the retaining clips are which must be carefully pried back, on connector labelled 1 in fig. 18 there is a cover, gently prying apart where the blue arrows are will remove the cover allowing access to the retaining clips below. There is also some glue on the edges of the PCB which needs removing. The PCB should now come away from the plastic case.

(Fig. 19) Caps



The five capacitors that require changing are of three different values. In fig. 19 opposite the capacitors are numbered with reference to table 9.

The replacement capacitors must be the same value and pitch as the old parts, the voltage can be higher, but not lower e.g. a 16v cap could be 25v but not 10v, the temperature rating must be the same or higher as well. Also note the polarity of the capacitors shown in fig. 19.

To replace the caps on the PCB you will require a good soldering iron, a good solder sucker or solder wick, some 60/40 tin/lead solder and a can of PCB lacquer. When removing the old caps **do not** keep the soldering iron on the PCB pads for any longer than 30 – 40 seconds as you'll risk damaging the PCB, you must also ensure that as much of the old solder is cleared from each hole as possible. A good tip here is to re-solder the joints to the caps first and then de-solder the joints, as this makes de-soldering easier. Next re-solder the new caps in place ensuring first you have the caps in their correct location and the correct way round. Finally re-coat the PCB with lacquer in that area.

While you have the instrument cluster striped down it would do no harm to replace all the light bulbs. Table 9 gives the quantity and BMW part numbers for the bulbs used. Table 9 also gives the part numbers for the OBC and Heater/fan panel bulbs.

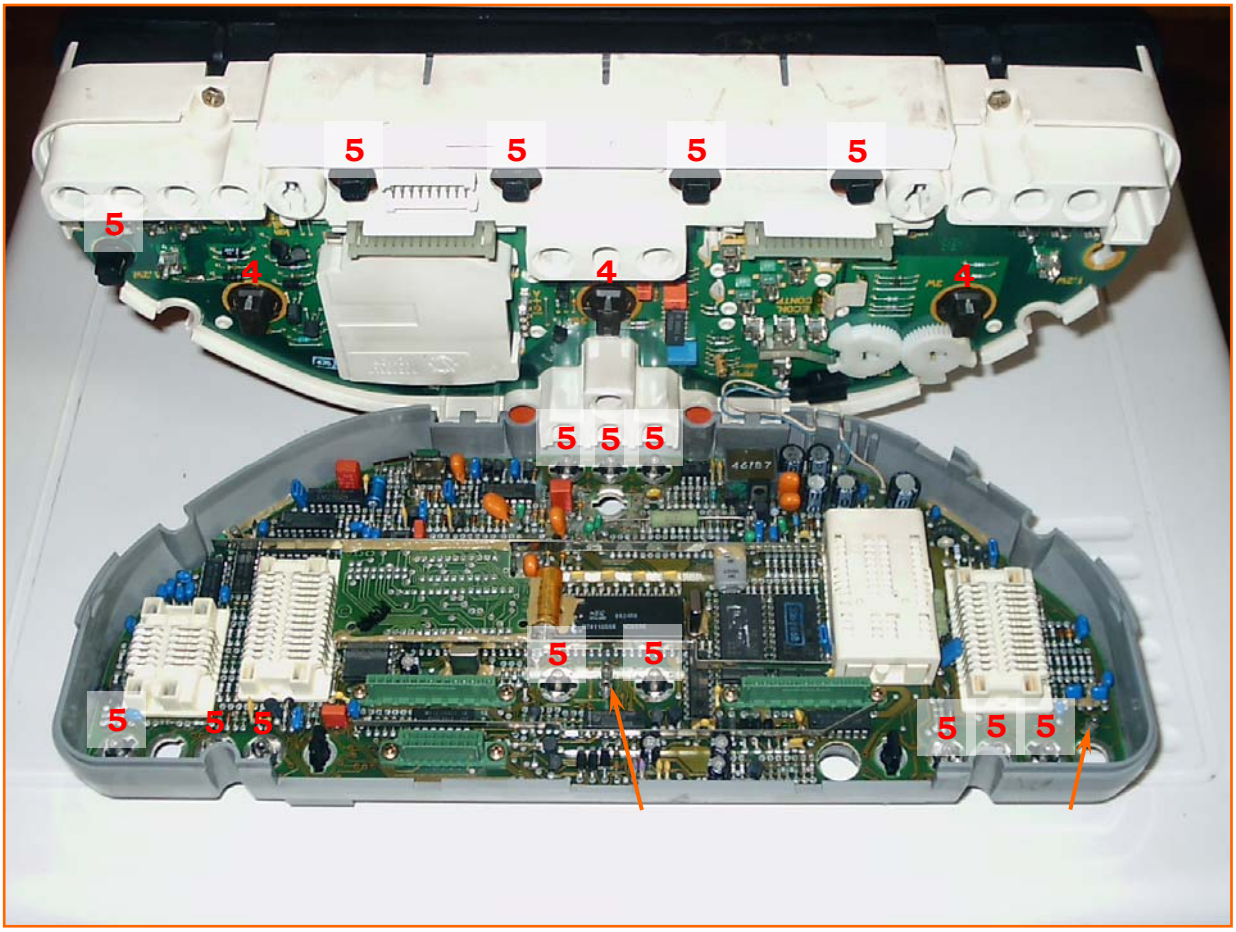
In fig. 20 below the bulbs are numbered with reference to table 9. Note also the orange arrows pointing to three small bulbs soldered to the PCB: these do not normally require replacing and the part numbers are not known for these bulbs.

Table 9 **Instrument Cluster Capacitors and Bulbs**

Item	Description	Qty.	Supplier	Part Number
1	22µf 40v Radial Electrolytic (Ref fig.19)	2	Farnell	
2	220µf 10v Radial Electrolytic (Ref fig.19)	2	Farnell	
3	220µf 16v Radial Electrolytic (Ref fig.19)	1	Farnell	
4	12v 3w Bulb with holder	3	BMW	07.11.9.978.372
5	12v 1.2w Bulb with holder	16	BMW	62.13.1.383.311
6	12v 1.5w Bulb with holder	6	BMW	62.11.1.391.260
7	Heater & Fan panel light	1	BMW	62.11.1.391.777
8	12v 1.2w OBC Backlight	3	BMW	62.13.1.383.311

Notes:-
1. All capacitors are 5mm pitch
2. Farnell is a UK electronics component supplier, but these parts can be sourced from any good electronics parts stockists.
3. 12v 1.5w bulb is used in the new type cluster manufactured after late 1989.

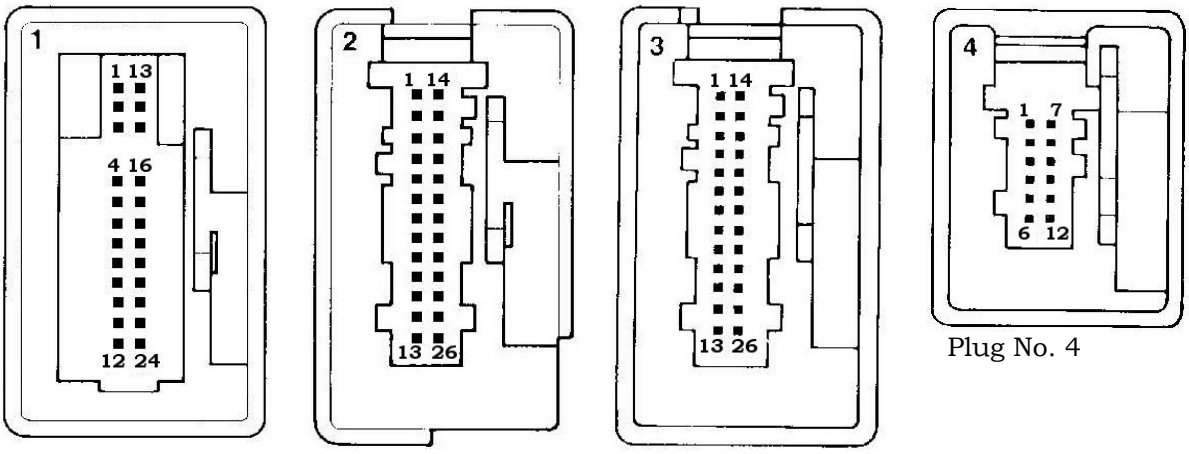
(Fig. 20) Instrument Cluster Bulbs



Unless further information comes to the attention of the author on repairing the instrument cluster (which would be added later) that is all that can be done to repair the cluster without spending lots of money.

Instrument cluster connector pinouts

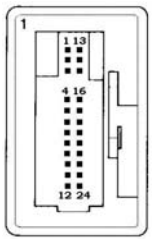
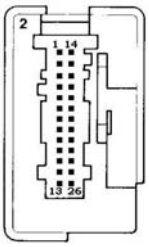
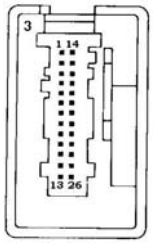
(Fig. 21) Cluster connectors

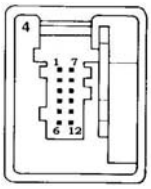


Plug No.1 Plug No. 2 Plug No. 3 Plug No. 4

Figure 21 above shows the cluster connectors and table 10 below gives all the pin allocations for the four of them.

Plug no. 1 is the coding plug (brown), Plug no. 2 is the front wire harness (beige), Plug no. 3 is the instrument harness (white) and Plug no. 4 is the rear wire harness (silver-grey).

Table 10	**Instrument Cluster Connector Pinouts**	
Plug Number 1 – Coding Plug (Brown)		
Pin No.	**Pin Function Description**	
1	Terminal 31 Ground	
2	Diagnostics Rx	
3	Terminal R	
13	Terminal 31	
14	Diagnostics Tx	
15	Terminal R	
4-12 & 16-24	Coding plug	
Plug Number 2 – Front Section (Beige)		
1	Airbag	
2	CLC Synchronisation lead to CCM/LKM	
3	LAC Transfer lead, control lead	
4	RKC activating lead of CCM diagnosis	
5	Charge control terminal 61, alternator - input (+)	
6	Oil pressure ground – input (-)	
7	Terminal 15 – input (+)	
8	VDO Internal	
9	VDO Internal	
10	Bb 2 brake pad wear – evaluation	
11	Turn signal indicator for trailer	
12	Terminal 30 +	
13	Terminal 30 +	
14	Not used	
15	Brake fluid ground – input (-)	
16	SI reset (Service Interval Indicator)	
17	Consumption ti-input, load signal corrected	
18	Speed TD form DME	
19	Test	
20	ABS	
21	(Airbag) terminal R not switched	
22	High beams	
23	DAC – data transmitting lead	
24	Coolant temperature – input (-)	
25	Bb 1 brake pad wear – evaluation	
26	Coolant temperature – input (+)	
Plug Number 3 – Instrument Section (White)		
1	Front fog lamps	
2	Gong output	
3	Fuel reserve warning lamp	
4	L2 Range display	
5	L1 Range display	
6	L3 Range display	
7	Not used	
8	L6 Program display	
9	L7 Program display	
10	Not used	
11	L4 Range display	
12	Not used	
13	Not used	
14	58g	
15	Rear fog lamps	
16	EML - Electronic engine power control	
17	EML - Electronic engine power control	
18	Speedometer “A”	
19	Not used	

Plug Number 3 – Instrument Section (White) continued		
20	Not used	
21	Not used	
22	Not used	
23	CC Button for BC blendout	
24	Not used	
25	Turn signal left	
26	Turn signal right	
Plug Number 4 – Rear Section (Silver-Grey)		
1	Not used	
2	Fuel tank reserve	
3	Not used	
4	Fuel tank level sender	
5	Electronic fuel tank sender (only Japan)	
6	Not used	
7	Parking brake ground signal – input (-)	
8	Terminal 31b distance pulse input	
9	Terminal 31b distance pulse DWA	
10	Terminal 31 distance pulse speedometer	
11	Not used	
12	Not used	

Relay and fuse details

Figure 22 shows the layout of the front power distribution box, with table 11 detailing all of the relays and what their allocations are. The fuse allocations are detailed in table 12. Figure 23 shows the rear power distribution box under the rear seat and table 13 details all the fuses in the rear power distribution box.

(Fig. 22) Front Power Distribution Box

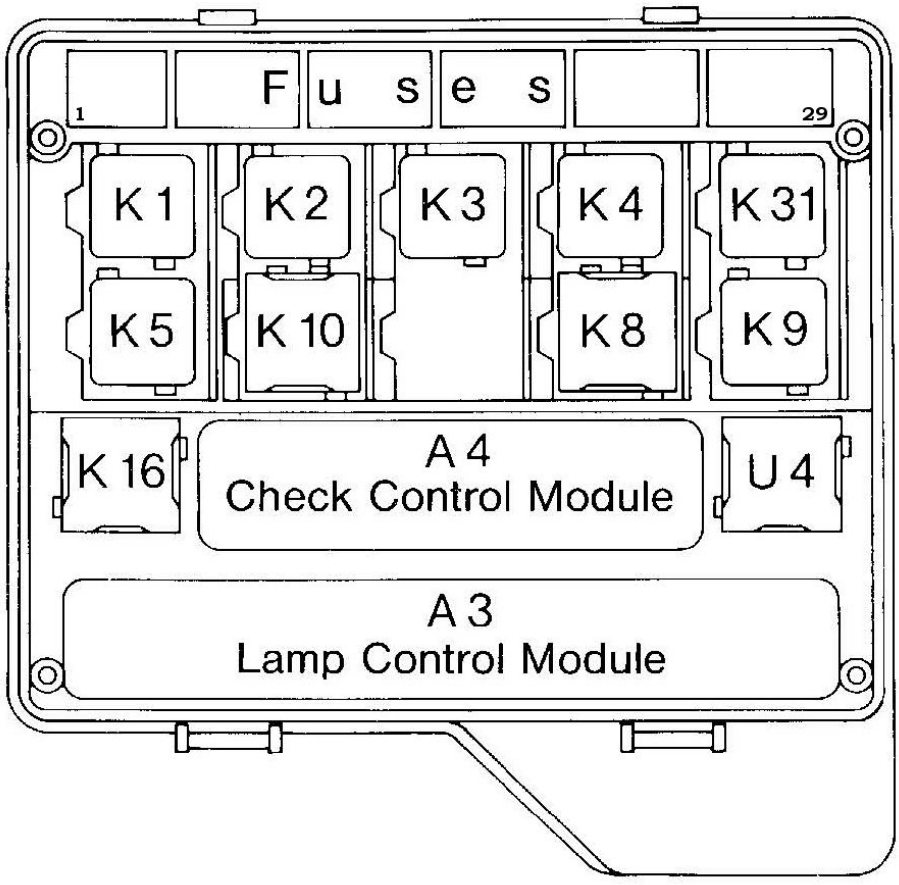


Table 11	Front Power Distribution Box Relay Allocations	
Relay No.	**Description**	**Colour**
A3	LKM (Lamp Control Module)	Black
A4	CCM (Check Control Module)	Black
K1	Bridge (for manual transmittion)	Yellow/Blue
Or K1	Starter interlocking relay	Yellow
K2	Two-tone horns	Yellow
K3	Power saver Terminal R	Yellow
K4	Heater blower/extra heater	Yellow/black
K5	Intensive cleaning/washer pump	Blue
K8	Additional water pump	Green
K9	Power saver terminal 15	Yellow
K10	Over voltage cut-out (ASC)	White
K16	Hazard light flasher	Black
K31	Cigar lighter (Australia only)	Yellow
Or K31	Bridge	Yellow
U4	Crash alarm sender	Grey

Table 12				Front Power Distribution Box Fuse Allocations
Fuse No.	**Term. No.**	**Wire Colour**	**Amps**	**Description**
1	R	VI,GE	15	Instru. cluster /LKM /stop lights /cr. Cont.
2	15	GN,BL	7.5	Dimmer relay /high beams
3	15	GN,GE	7.5	Flasher /front fog lamps relay /fog lamps
4	30	RT,GR	7.5	Parking lamp left
5	30	RT,BL	10	Parking lamp right /Instru. lamps /licence plate lamps
6	30	RT,SW,GE	7.5	Hazard lamp switch
7	30	RT,BR	15	Front fog lamps
8	30	RT,VI	7.5	Rear fog lamps
9	30	RT,SW	15	Horns – left & right/water pump /windscreen heating / Air Con. Compressor
10	56b	GE,GN	7.5	Low beam left
11	56b	GE,BL	7.5	Low beam right
12	15	GN,SW	15	Backup light switch /DKV /mirrors – left & right / heated washer jets
13	56a	WS,GN	7.5	High beam left
14	56b	WS,BL	7.5	High beam right
15	R	VI,BR	7.5	Extra heater /rel. coil /wipers /CCM /BC
16	15	GN,SW,GE	30	Seat heating front
17	15	GN,RT	7.5	GM /DWA /Instru. cluster /automatic transmission
18	R	VI,WS	15	Radio /GM /telephone /DWA /power seats front /AHM seat belt control unit
19	15	GN,BR	30	Heater blower
20	30	RT,GE	7.5	Gong /BC /CCM /Instru. cluster /heater /extra heater
21	15	GN,BR,GE	7.5	Heater electronics
22	30	RT,BL,GE	30	AHM /SRA /ADV
23		GN,VI	7.5	EK P I
24		GN,GR	7.5	EK P II
25	30	RT,GN	30	Extra fan stages I & II
26	30	RT,WS,GE	30	Cigar lighters front & rear
27	30	RT,GN,GE	30	Power seats rear
28	15	GN,WS	15	Servotronic /motor
29	15	GN,BL,GE	7.5	Air compressor relay /extra fan stage I relay /extra fan stage II relay /FSH relay /water pump /ABS relay / relay coil /power seats rear /HHS relay /inside mirror / wheel chamber warning switch /log sensor