

On-Board Computer Installation Manual
for BMW E36 Compact
by dkostas

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1. The Parts Needed to Install The On-Board Computer (OBC)



Part	Photo	
<p>On-Board Computer/Clock. It should have 2 buttons: S/R and clock. If it shows only the clock, it should be coded. If you have found one which works as OBC (shows more than just a clock) then it will work with any car, however, the computations of fuel consumption will be based on that car it is taken from. To change the settings you will have to code it.</p>		
<p>OBC connector. There are 2 types of connectors: one for the clock with only 4 wires (first photo), and one for the OBC with 11 wires (second photo). The connector can be disassembled and additional wires can be added, or you can make your own connector from scratch, connecting each wire individually to the back of the OBC.</p>		

Turn signal lever with BC button. Fits one from sedan version as well. You can also use any other button installed anywhere else in the car instead of using this.

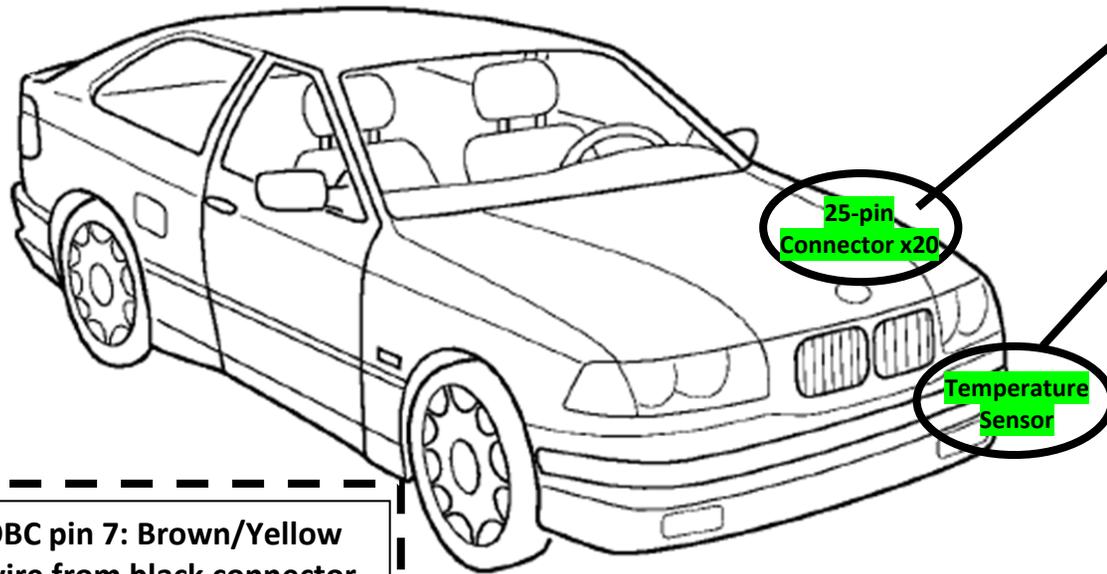


Outside temperature sensor B21 with connector X770. It can probably be replaced with temperature sensor from other BMW models but have not tried that.



Some wires, connectors, various tools, etc.

2. OBC Installation Overview



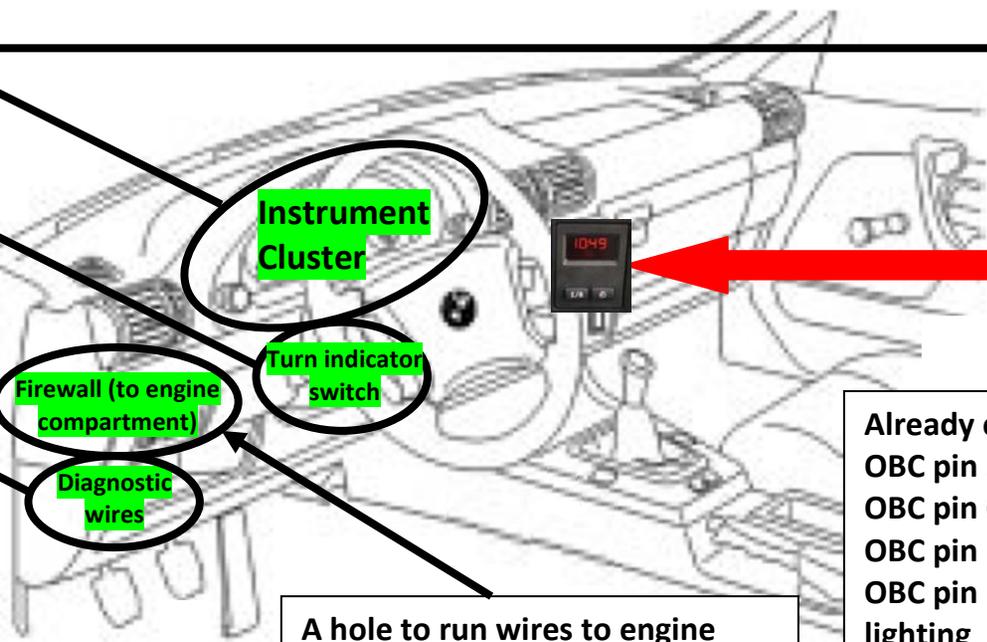
OBC pin 4: White/Black wire from 25-pin x20 connector (TI or Economy signal)

OBC pin 6: Brown/Orange wire from temperature sensor (ground, shares the wire with OBC ground)
OBC pin 8: Brown/Gray wire from temperature sensor (signal)

OBC pin 7: Brown/Yellow wire from black connector
OBC pin 9: Black/White wire from blue connector

OBC pin 1: Brown/Red wire from operating switch

OBC pin 2: White/Violet wire
OBC pin 3: White/Yellow wire



All wires comes to OBC (clock)

Already connected to OBC clock:
OBC pin 5: Red/Yellow wire. Terminal 30
OBC pin 6: Brown/Orange wire. Ground
OBC pin 10: Violet/Yellow wire. Terminal Ra
OBC pin 11: Gray/Red wire. Instrument lighting
OBC pin 12: no connection

A hole to run wires to engine compartment (Firewall)

3. Tools

- This manual
- Some tools.

Usually all the standard tools are OK, except some special ones. BMW uses in many cases star or hex screws so be prepared to have some screwdriver able to unscrew those. Other than that refer to the list on the right from original installation manual.

Tools and materials required

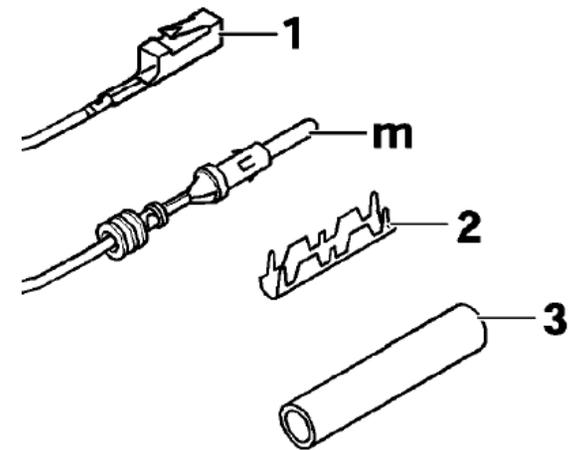
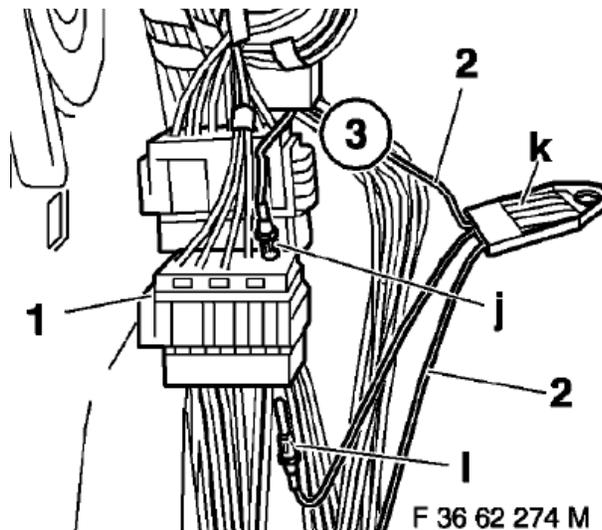
Phillips screwdriver
Ratchet with 1/2" drive
1/2" drive socket, A/F 10 mm, 13 mm
1/2" extension
Ring spanner, A/F 7 mm, 10 mm, 13 mm
Electric torch
Inspection lamp
Regular screwdriver
Wire stripper
Cable pliers
Side cutting pliers
Socket wrench, A/F 8 mm, 10 mm
Universal knife

I personally recommend getting flexible extension for screw driver/drill. It will speed your work considerably.



Flexible extension for screw driver/drill (source: ebay)

- Original OBC installation manual, however it is not necessary. The manual you are reading now has everything covered. There are some additional pictures shown you may be interested to see, but other than that it is a bit confusing and asks you to do things which are meant to be done by some official BMW technician only. For example, wire tap-in procedure is very complicated in some cases. Instead of tapping into the wire directly, they show that you have to go through connector. That means you have to install some metal pins into some existing connectors somewhere in your cars wire harness. You can see this example in the picture below. Moreover, you don't need to do some of the procedures at all, such as disassemble of a glove box.

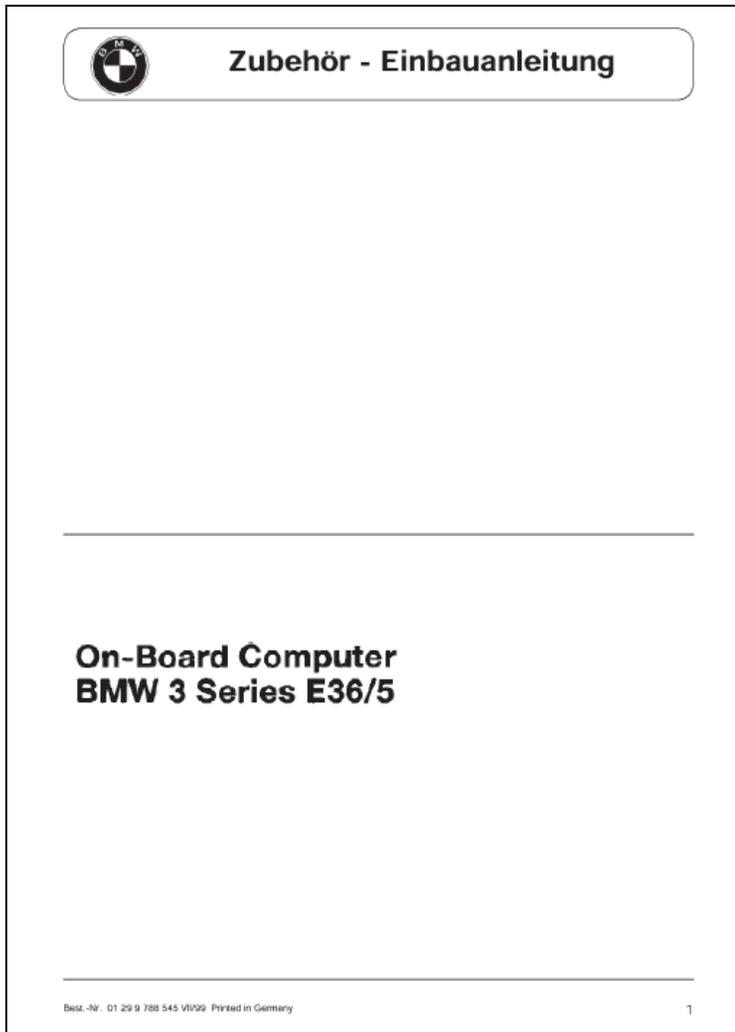


A simple tap-in procedure becomes complicated if done following the original manual (from original installation manual)

You need to get some special BMW parts to do a simple tap-in procedure (from original installation manual)

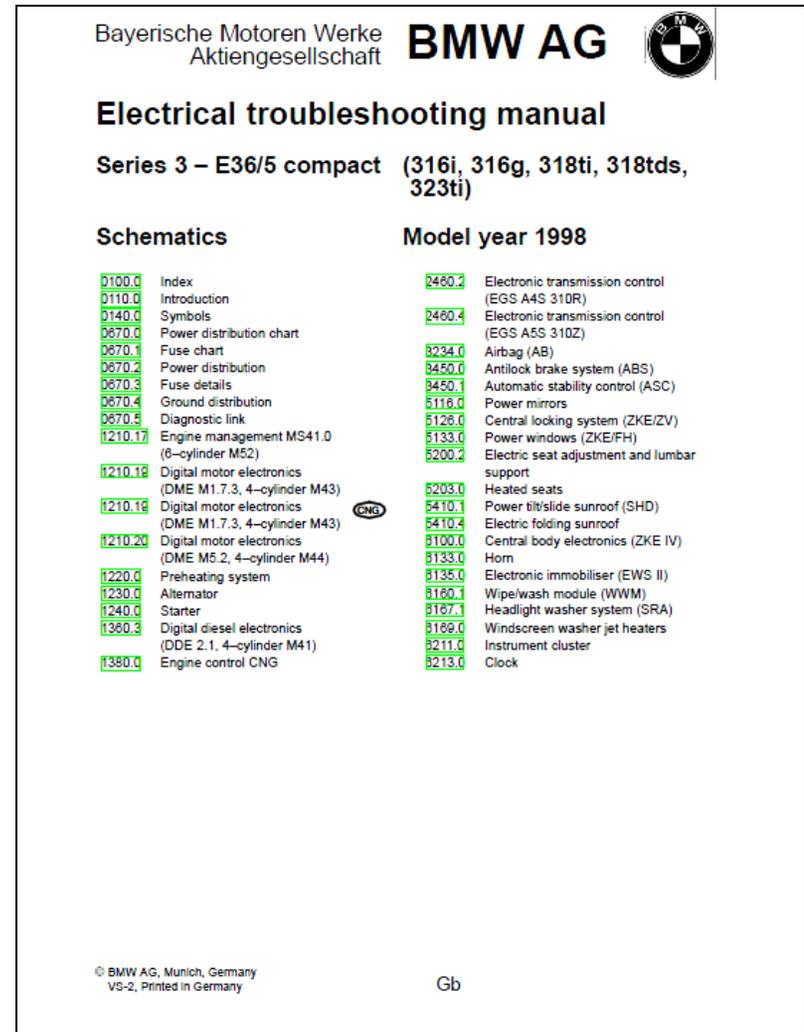
- Original BMW manuals:

OBC installation manual



Original OBC installation manual

Electrical Troubleshooting Manual (ETM)

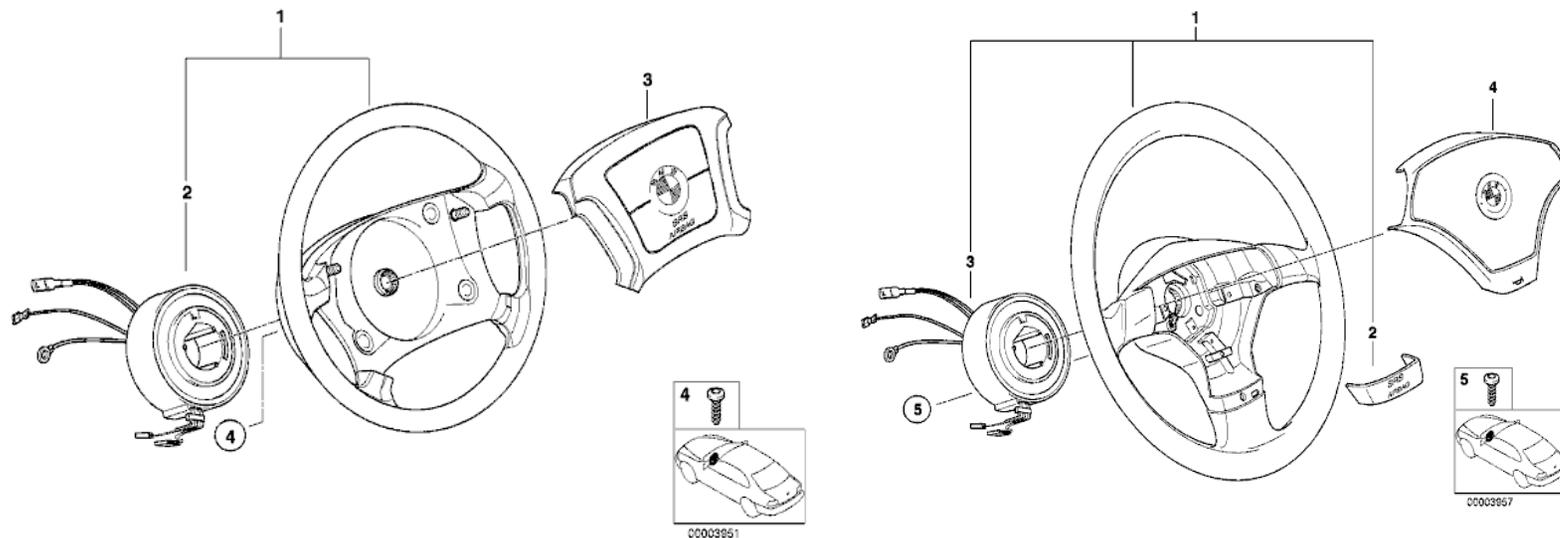


Very useful manual which covers electrical part of your car

You can probably find these documents by googling around, reading forums, etc.

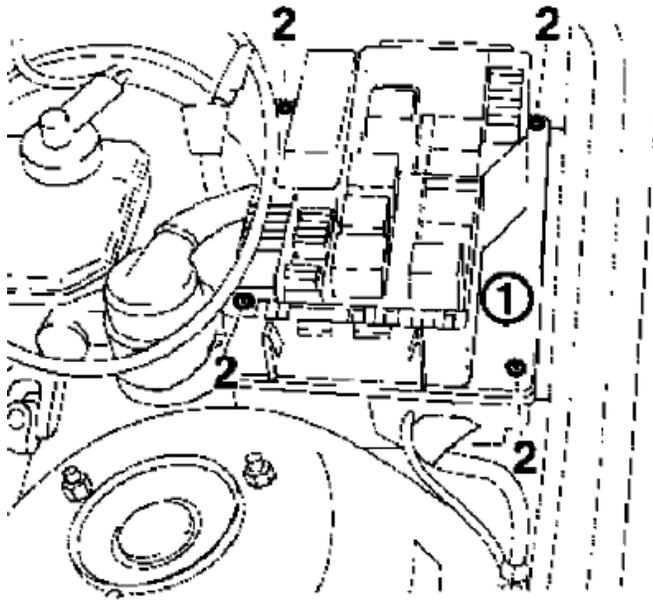
4. Preparation

- Disconnect vehicle battery. You will have to remove the steering wheel and disconnect an airbag to change the turn indicator switch.
- Remove all the paneling on driver side below the steering wheel. Make sure you removed all the panels so that you can access the place where all wires go to the engine compartment (firewall).
- Remove the front panel around OBC, car stereo, air heating, etc. Depends what you have installed there it is not necessary to take it off completely. If you are able to run some wires from below steering wheel to the OBC clock you will be fine without removing everything.
- Remove the steering wheel and steering-column paneling

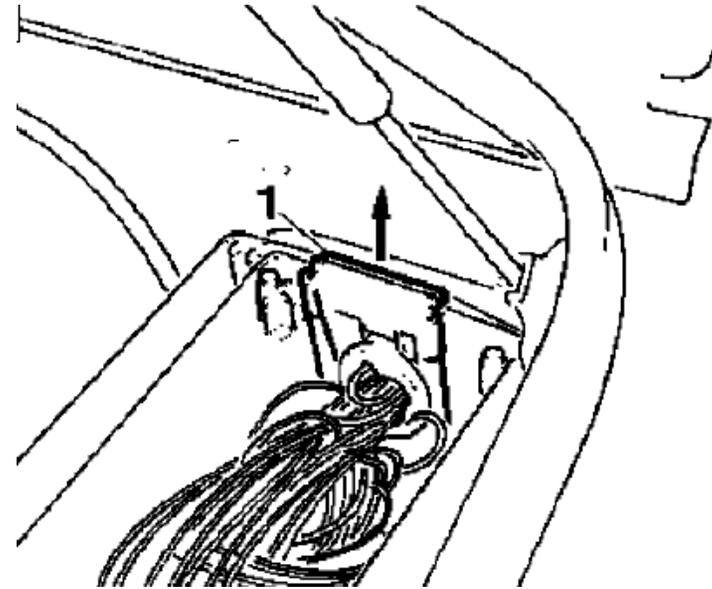


Instructions how to remove a steering wheel (from: www.realoem.com)

- Remove turn-indicator/driving-light switch (more detailed instruction of this procedure is available here: <http://www.unofficialbmw.com/john/parklicht.html> or just use Google)
- In engine compartment remove the fuse box



Unscrew 4 screws (star or hex type) to open fuse box. Inside you will find something like shown in the right picture. Run 1 wire from X20 connector and 2 wires from temperature sensor to this box, and then channel those wires trough the firewall. Pictures from original installation manual



You do not have to remove the part shown as 1. It is possible to run 3 wires without doing that.

Use this trick:

Use some strong wire to route 3 wires from engine compartment into the car. 1) Route the strong wire from inside the car to the engine compartment through the firewall. 2) Attach it to the other 3 wires and using some force pull the strong wire back inside.

5. Connecting Wires

You can tap-in wires in a few ways:

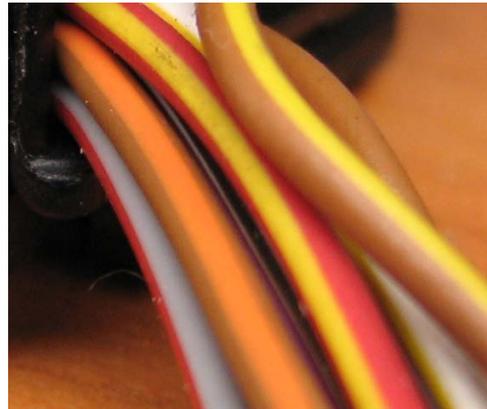
- by using special connector which allows to connect a new wire to existing one without cutting anything or soldering (bulky, not as reliable as soldering but works, easy and fast installation)



Tap connector

- by soldering (slow and you can damage something by working with soldering iron, because some places are hard to reach)

About the colors. If anywhere in this manual it is said to look for a wire with color combination such as Brown/Yellow, that means that Brown color is dominating in that wire and takes approximately 2/3 of the area, while the second color will take some 1/3. See figure bellow (the wire on the top is Brown/Yellow, the one below is Red/Yellow, etc.).

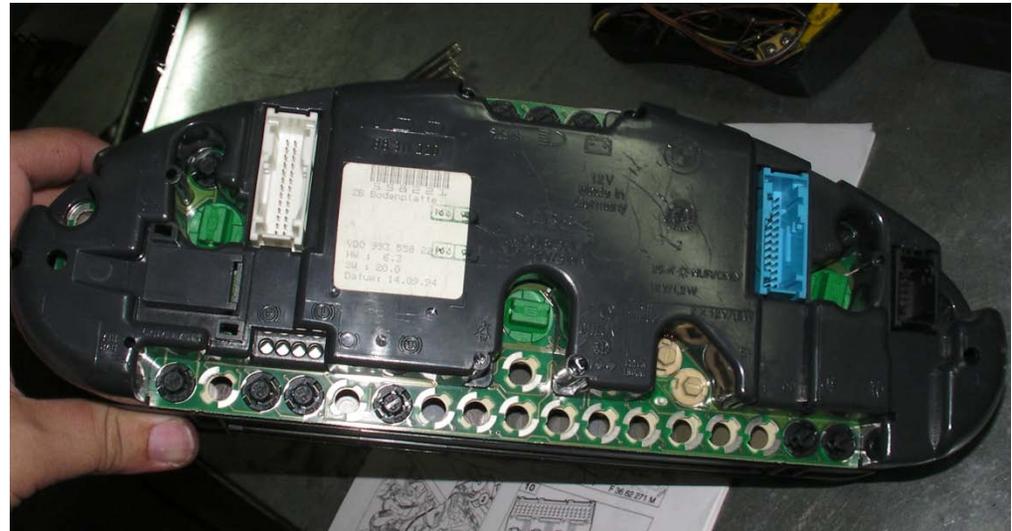
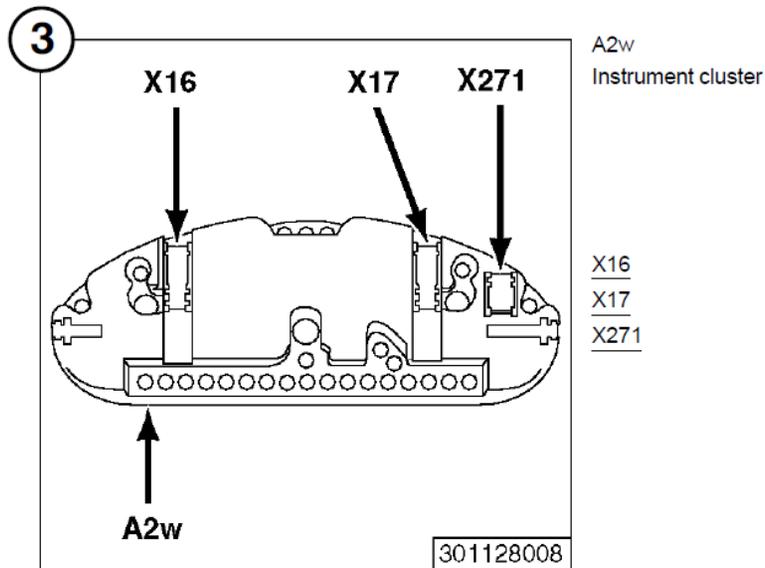


BMW color coding

6. Instrument Cluster

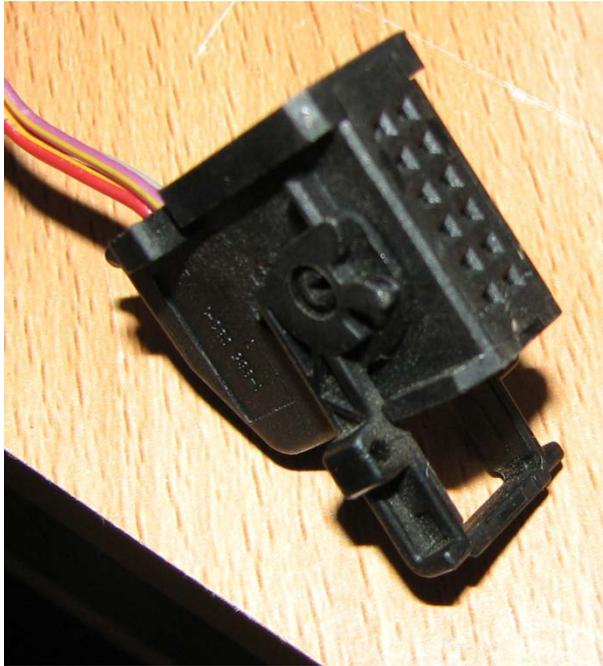
In instrument cluster there are 2 wires we have to connect:

- To fuel level sensor wire: should be connected to OBC pin 7. The wire which runs to instrument cluster is in Brown/Yellow color and is connected to the Black connector (X271, see the picture below)
- To speed sensor wire: should be connected to OBC pin 9. The wire which runs to instrument cluster is in Black/White color and is connected to blue connector (X17, see the picture below)

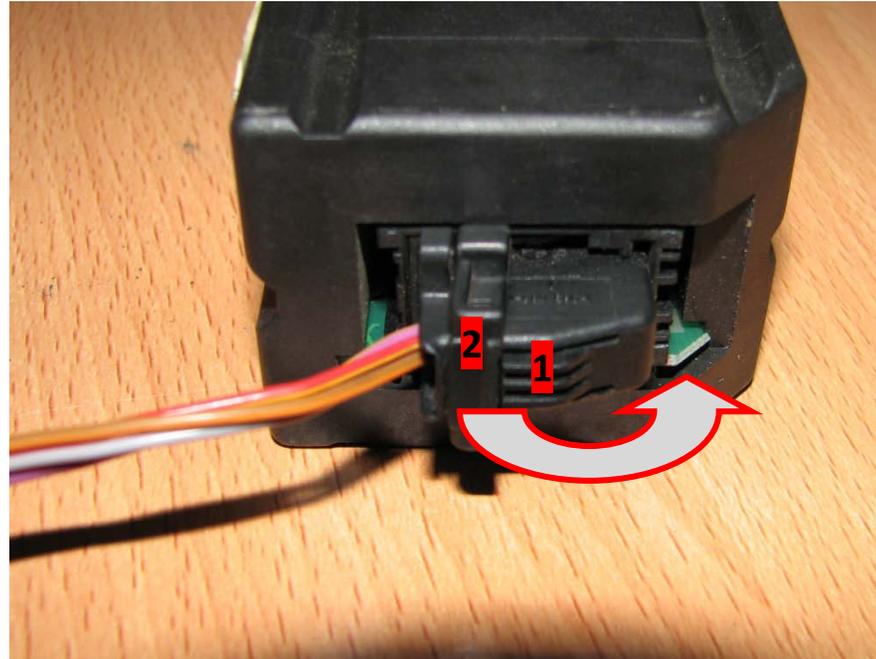


Instrument panel from the back side (X16 – White or Beige, X17 – Blue, X271 – Black).
Picture on the left is from ETM

All instrument cluster connectors and OBC connector are so called Pigtail connectors (see the picture bellow).



Pigtail connector - open



Pigtail connector – closed. To open it you have to push part 1 and slide part 2 as the arrow shows. Instrument cluster connectors work in the same way.

To connect to required wire you simply locate the instrument cluster connector and tap into the wire somewhere further from it. You can also follow the wire as it goes to wire harness somewhere below the steering column and connect there.

7. Turn Indicator Switch

Replace the old turn indicator switch with the one which has a BC button (turn indicator switch on E36 Sedan and Compact are the same). The indicator switch with BC label will have the same connector as the old one, except that it will have one more wire going to the connector. You will have to tap into that wire. It should be Brown/Red, but you can also compare the old switch and the new one and figure out which is the required wire. Connect the wire to the OBC pin 1.



Turn indicator lever without BC button



Turn indicator lever with BC button

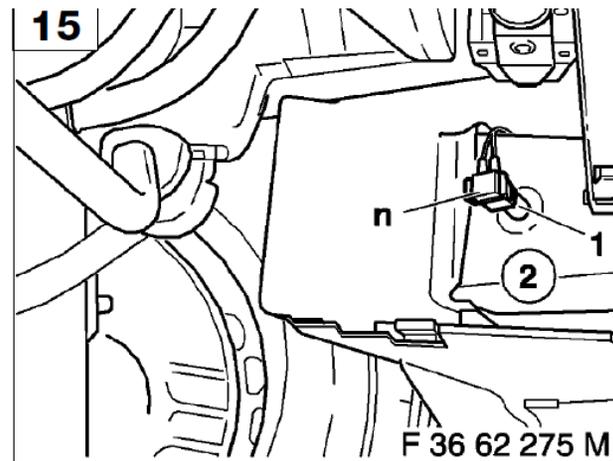
8. Temperature Sensor

The temperature sensor has 2 wires:

- Brown/Orange wire: should be connected to OBC pin 6 (Brown wire). This is the ground for the sensor and in our case we will connect it to the ground of OBC which is on pin 6 (Brown wire). The original OBC installation suggest running the wire somewhere behind the glove box, but really, what is the point if we can just connect two wires together on the OBC.
- Brown/Gray wire: should be connected to OBC pin 8. This is the data signal.

Press outside-temperature sensor B21 (1) into existing opening in front-left brake ventilation duct (2).

n Lay branch for cable connector X770 through distribution box along vehicle wiring harness to outside-temperature sensor B21 (1) in front-left brake ventilation duct and connect.



(1), (2) and **n** are shown in the right picture Basically it means to route 2 wires from OBC to the temperature sensor and install the sensor in brake ventilation duct (from original installation manual)

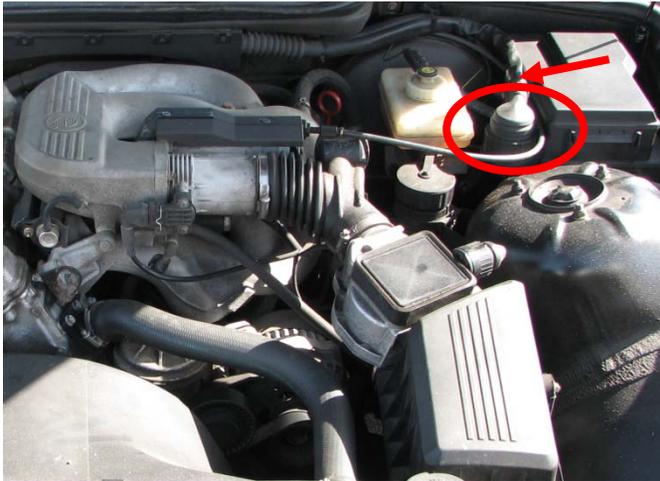
It looks simple and probably it is, but in my case there was no such thing as brake ventilation duct, so I have placed the sensor just above the front bumper using zip tie (from original installation manual)



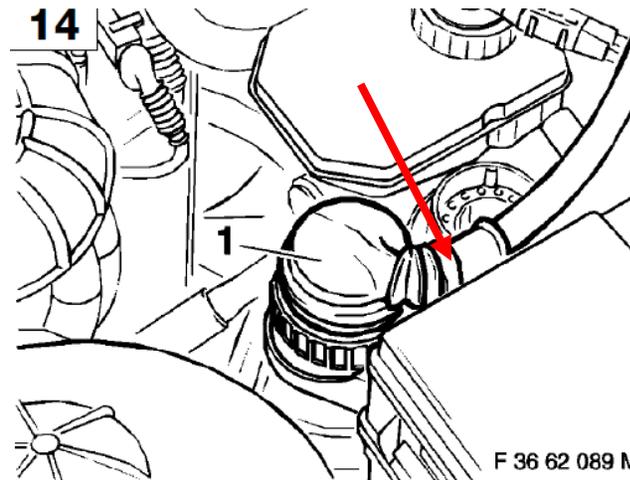
Temperature sensor consist of 2 parts: connector X770 and sensor B21

9. X20 Connector

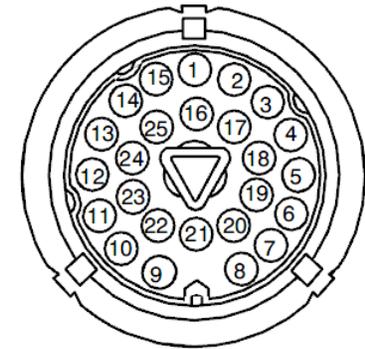
The wire from 25-pin X20 connector (in engine compartment) should be connected to the OBC pin 4. The wire to look for is White/Black one. If you cannot find it, then look for the 24th position on that connector.



X20 location and location for tapping-in. TI signal (economy signal) wire comes from MCU to this connector, but from this connector there is no wire going further (connector has empty slot).



You should tap into the wire coming from MCU. Look for the White/Black wire. The arrow shows where to tap-in. There is some sort of protecting rubber just before the connector which slides off without any problem and you get all the wires to choose from. You can also put the wire between the cable and that rubber, so the tapping is easy here. (from original installation manual)



X20 connector, the TI signal is on the 24th pin. (from ETM manual)

10. Diagnostic Wires

These are needed so that your OBC can communicate through diagnostic connection with testing equipment. There are two wires:

- Diagnostic TXD wire: should be connected to OBC pin 2. The wire is in White/Violet color and you can find it somewhere under the steering wheel near the firewall. There are many other devices in your car which uses the same diagnostic links and they use the same color wires, so you can tap practically to any wire which has the same color combination. My advice would be to find the place where all wires with White/Violet color combination meet together in one place (connector) and tap in it there.
- Diagnostic RXD wire: should be connected to OBC pin 3. The wire is in White/Yellow color. The connection is similar like in TXD wire case, so follow the same instructions just don't forget about colors.

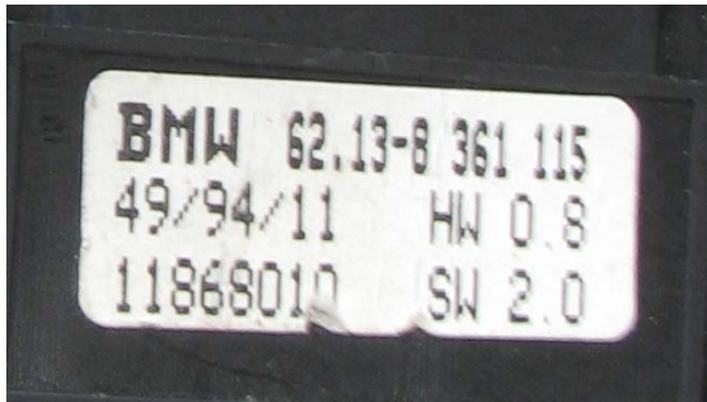
If you have the clock with S/R and clock symbols (see pictures bellow) that means you have an OBC. But even if you have OBC it does not mean that it will work. If your car was not equipped with on-board computer the clock should be activated to act as OBC. To do that one has to use Modic/DIS testing unit. In my case I have got the clock from other car where OBC was preinstalled, so no coding or activation was needed, but to wake-up the simple clock you will need to code it. I have tried 3 other clocks and they look exactly the same, but one works and the other don't. The labels are the same, the hardware numbers are the same and even using diagnostic connection in Inpa software the simple clock is recognized correctly and shows some values from the sensors it is connected to, but in order to make it show something on the clock's screen it should be activated.



OBC



OBC close up



One of those works, the other does not, but which one is which it is impossible to tell from the labels, because the software and hardware is exactly the same

Here are some instructions I have found on the internet about how you can code your clock:

Your local Dealer can recode your OBC with the so called "Modic/DIS" - testing unit. This equipment has every BMW-Dealer.

You basically let your car know, that's an OBC is installed and program the right car type into your obc.

You can do it as follow:

Let your dealer do this steps:

Plug in the Modic - Unit into your car's diagnostic socket.

Select your Car-Type from the Menu.

Then you can choose some sort of diagnostics and other things.

One Menu Item is the so called "Electronic Retrofit"

In this Menu you can choose all sort of Retrofitting electronics, such as OBC Unit (BC V), PDC, Power Windows, etc...)

The Recoding may take several Minutes.

You need to turn the ignition on and off (the testing unit will instruct you.)

Done.

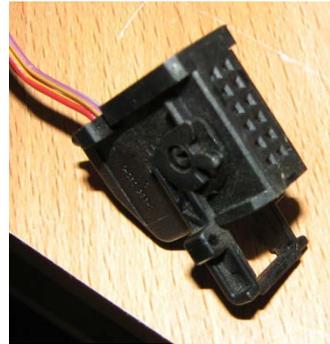
I have tried to follow these instructions, but I have failed at some point, because of some unknown reasons. Probably the guy who tried to code the clock did not know how to work with DIS. My car is old (made in 1994) and DIS did not recognize my vehicle correctly. I think car selection should have been done manually somehow, but the guy did not know how to do it so I left without results (it was too expensive and not worth it to play around).

11. On-Board Computer (Clock)

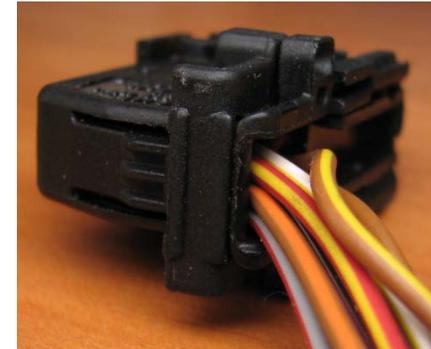
The OBC if not coded is meant to show the clock only. It will not show anything even if you will connect all the required wires to it. On the back it has 12-pin connector, which in OBC case have 11 wires, and in clock-only case 4 wires.



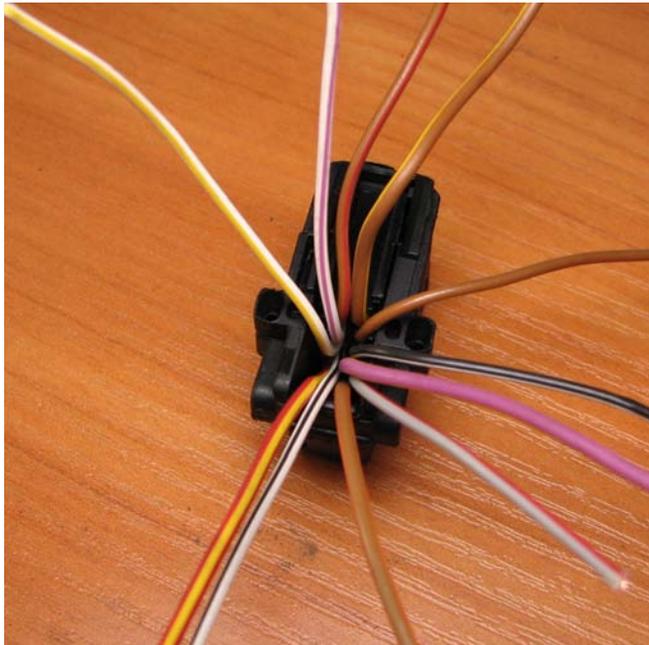
Back side of OBC



OBC connector with 4 wires



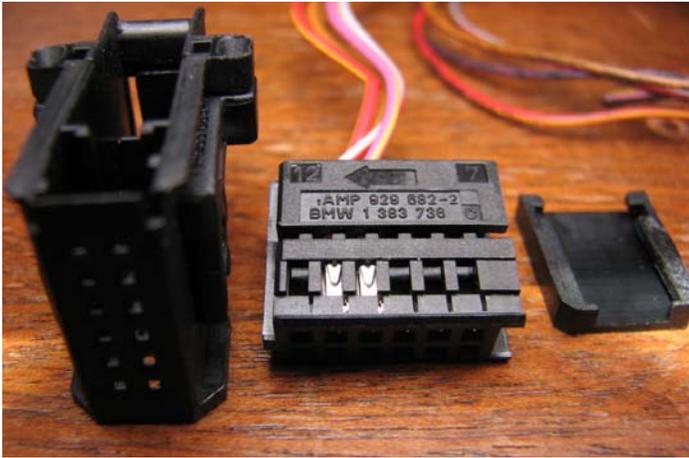
OBC connector with 11 wires



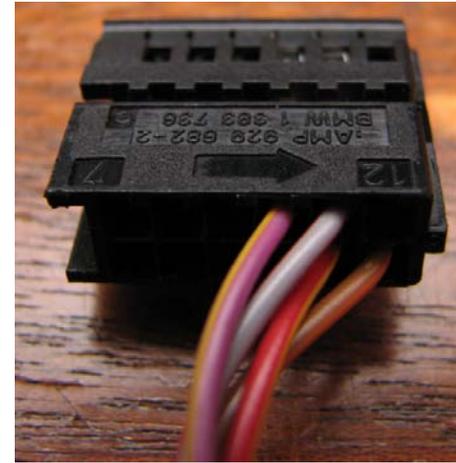
All wires shown of original OBC connector



You can disassemble it



Fully disassembled OBC connector with 4 wires



Back side of connector

Clock-only connector	OBC connector
<ul style="list-style-type: none"> ● Pin 1 – Not connected ● Pin 2 – Not connected ● Pin 3 – Not connected ● Pin 4 – Not connected ● Pin 5 – Terminal 30 ● Pin 6 – Ground ● Pin 7 – Not connected ● Pin 8 – Not connected ● Pin 9 – Not connected ● Pin 10 – Terminal Ra ● Pin 11 – Instrument lighting ● Pin 12 – Not connected 	<ul style="list-style-type: none"> ● Pin 1 – Turn signal switch ● Pin 2 – Diagnostic TXD ● Pin 3 – Diagnostic RXD ● Pin 4 – TI signal (economy signal) ● Pin 5 – Terminal 30 ● Pin 6 – Ground + temperature sensor ground ● Pin 7 – Fuel level sensor ● Pin 8 – Temperature sensor data line ● Pin 9 – Speed sensor ● Pin 10 – Terminal Ra ● Pin 11 – Instrument lighting ● Pin 12 – not connected

Since wiring the OBC will require using your own wires which will not have the same colors as original, so here is the useful table to use during installation:

OBC Pin	Connects To	Original Color	New Color
1	Operating switch	Brown/Red	
2	Diagnostic TXD	White/Violet	
3	Diagnostic RXD	White/Yellow	
4	TI signal (economy signal)	White/Black	
5	Terminal 30	Red/Yellow	
6	Ground + temperature sensor	Brown + Brown/Orange	
7	Fuel-level sensor	Brown/Yellow	
8	Temperature sensor	Brown/Gray	
9	Speed sensor	Black/White	
10	Terminal Ra	Violet/Yellow	
11	Instrument lighting	Gray/Red	
12	-	-	-

12. OBC Usage

Refer to your BMW E36/5 Compact Users Handbook pages 58-60. For those who do not have one:

 <p>The image shows a rectangular digital display unit. The top section is a dark screen with white LED digits showing '1:36'. Below the screen are two buttons: the left one is labeled 'S/R' and the right one has a clock icon.</p>	<p>Digital Clock.</p> <p>Can show 12h or 24h format. Once you turn on the car, the clock is shown (it does not remember about which setting was left when you turned it off, so other OBC displays will never be shown on startup). If the car is not turned on, you can see the clock by pressing Clock button for a few seconds. The clock resets once battery is disconnected.</p> <p>To change the time and time format you press both: S/R and Clock buttons for a few seconds. Then use Clock button to change values and S/R button to save the value.</p>
 <p>The image shows a rectangular digital display unit. The top section is a dark screen with white LED digits showing '- 2.5°C'. Below the screen are two buttons: the left one is labeled 'S/R' and the right one has a clock icon.</p>	<p>OBC – Temperature</p> <p>Shows outside temperature. If temperature falls down under +3°C, the signal sounds to warn driver about possible icy road.</p>



OBC – Average Fuel Consumption

Shows how much liters of fuel your car uses on average to go 100 km. Once in this mode you can reset the value by pressing S/R button. Unfortunately this does not show instantaneous fuel consumption which would be of much more valuable use. However you can sort of achieve this by continuously pressing the S/R button which is very impractical and can lead to car accident.



OBC – Expected Range

Shows how many kilometers you can drive before refueling. It is based on current driving mode, so if you drive fast this will go down, if you will drive slowly – it will go up. If the 3 dash lines blink on the screen, it means that there is less than 15 km left to drive and one should consider refueling.



OBC – Average Speed

Shows your average speed in kilometers per hour. It counts the average speed until you reset it. To reset it press S/R button while in this mode. If the speed is under 100 km/h, the display shows number with 1 decimal number.

Pictures taken from the official BMW E36/5 Compact Users Handbook

To switch from one display to another use turn signal levers BC button

13. OBC Configuration

The normal menu is accessed by pressing S/R and Clock buttons at the same time for a few seconds. Using the indicator button (BC) you can move through the menu options. Once selected the correct submenu, press the S/R button to enter it. Then with the clock button make changes. To save changes press S/R, to cancel changes press the BC button.

Operation	Command
Menu	S/R + Clock buttons at the same time for 2 seconds
Move through menu Cancel changes Move through OBC display	BC button
Enter submenu Save changes	S/R button
Make changes	Clock button

Menu	What it does
# 01	Time format (12/24h). Change time format from 12h to 24h or vice versa
# 02	Display test. OBC shows all symbols it can show
# 03	Fuel rate calibration factor. By default it shows 1000. Here you can adjust your fuel consumption figures if they do not match the truth.
# 04	Shows "LSP" and beeps. It is not clear what it means. You cannot do anything with this menu. If you do nothing it goes out of this menu in 1 or 2 seconds. If you press any of the 3 available buttons while in this menu, it does the same, just quits the menu.
# 05	Temperature format. In my OBC there is no menu # 05

How to adjust the fuel consumption

We need to have 3 values:

1. Fuel consumption figure shown by OBC (l/100km, e.g. FC = 9 l/100km)
2. The actual consumption figure you have to figure out (l/100km, e.g. FCA = 8.43 l/100km)
3. The current fuel rate calibration factor shown by OBC (from menu # 03, by default FRCF = 1000)

Having these three values we can compute the new fuel rate calibration factor (FRCF_new) which will adjust consumption shown on OBC to match the actual consumption. Probably this can be used to calibrate OBC if it comes from the car with different engine capacity (e.g. 1.6, 1.8, 2.3), but I am not sure about that.

$$\text{FRCF_new} = \text{FRCF} * \text{FCA}/\text{FC} \quad \Rightarrow \text{ from example above: } \text{FRCF_new} = 1000 * 8.43 / 9 = 936.66 \approx 937$$

Now we have to go to OBC configuration menu # 03 and enter this new value (937) instead of the old one.

How to get the actual and current fuel consumption figures

1. Fill your car with fuel in some gas station until it fills it to the click (full tank).
2. Write down the number of kilometers your car have drove so far (NK, e.g. NK=212000 km)
3. Reset the actual consumption figure (select actual fuel consumption with BC button and press S/R button to reset it)
4. Drive around for some time until you need to refuel (the emptier tank is the better accuracy you can achieve)
5. Come to the same gas station, to the same gas pump and preferable at the same time of day and fill your tank again to the click (full tank)
6. Write down the fuel consumption figure shown by OBC (FC, e.g. FC=9 l/100km).
7. Write down the number of kilometers your car have drove so far (NK_new, e.g. NK_new=212510 km)
8. Write down how much fuel you have just filled into the tank (FU, e.g. FU=43.0 l)
9. Compute the actual fuel consumption figure (FCA). $\text{FCA} = \text{FU} / ((\text{NK_new}-\text{NK})/100)$
e.g. $\text{FCA} = 43.0 / ((212510 - 212000)/100) = 8.43 \text{ l/100km}$