Reading the error log yourself

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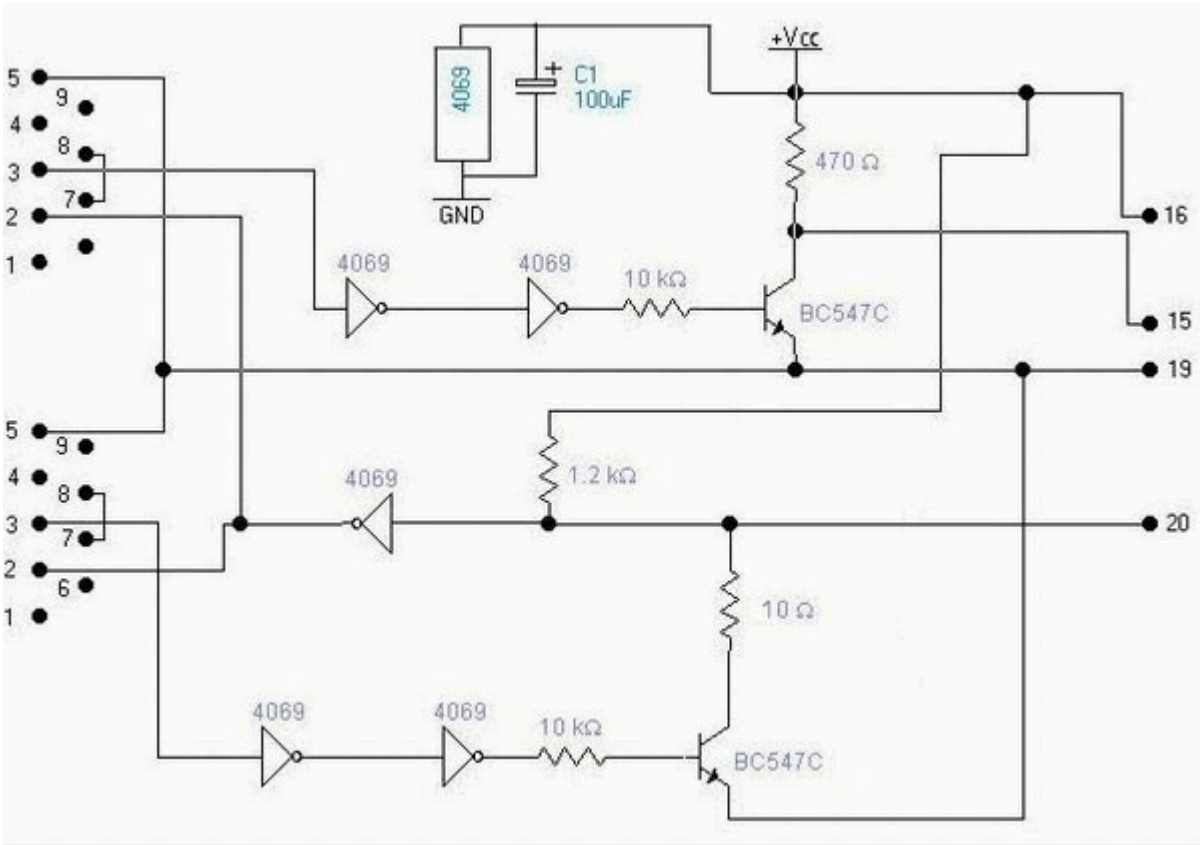
Okay. At the request of many, I have finally decided to report on my experiences with reading the error codes via the diagnostic socket of our beloved 5 Series. The models in the E34 series are diagnostic-capable, which means that it is possible to read error messages from the digital engine electronics (DME), the central body electronics (ZKE) and many other body and control units using a "diagnostic computer" in a suitably equipped workshop. This often saves a lot of searching and work when it comes to eliminating problems, e.g. with the engine running. This document would not be found in the DIY corner if I did not describe how you can assemble such a diagnostic system YOURSELF and inexpensively. But a word of warning... Always remember that the DME and the ZKE are very sensitive components. You should therefore check and consider twice, three times - or even four times - which cable you connect to where on the diagnostic connector. Otherwise you will have to get new control units very quickly... I am therefore in NO WAY liable for any damage that occurs due to incorrect or improper following of these DIY instructions.

EVERYONE MUST KNOW WHAT THEY ARE DOING AND EXERCISE THE NECESSARY CARE!!!

OK, now enough of the doom and gloom. We want to get started.

Well, the principle of data exchange is actually very simple: The vehicle to be examined sends its data to the diagnostic PC via the diagnostic socket (TX) and back (RX). In between there is a small interface that serves to buffer and control the voltages that occur.
Our first task is to build such an interface.

The interface:
Here is the circuit diagram:



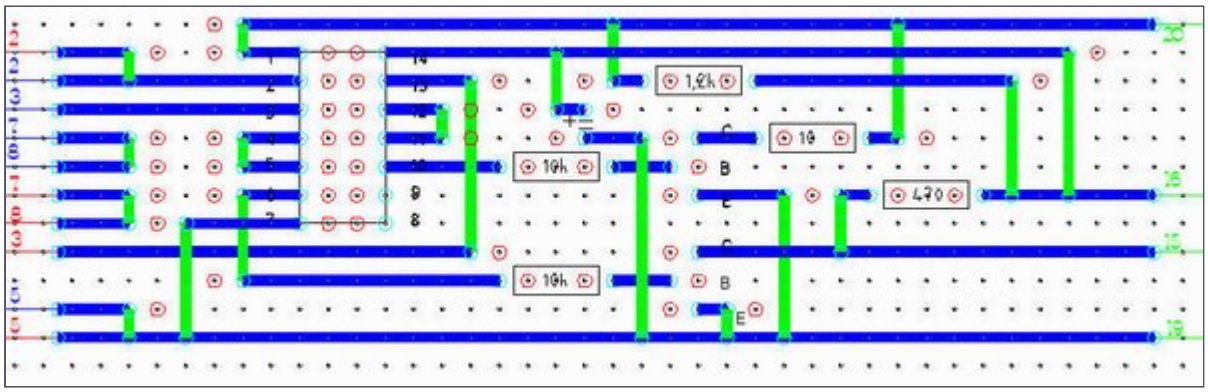
For this circuit you need the following parts:

component	order number
1 IC 4069 (negation module)	MOS 4069
1 IC socket	GS 14
1 resistor 10 Ohm	1/4 W 10
1 resistor 470 Ohm	1/4 W 470
1 resistor 1.2 kOhm	1/4 W 1.2K
2 resistors 10 kOhm	1/4 W 10K
1 electrolytic capacitor with 100µF	RAD 100/16
2 transistors, type BC547C	BC 547 C
2 SUB-D socket	D-SUB BU 09
2 SUB-D cap	cap 09M
10M control cable	LIYCY 06-10

In addition:

- a PC with 2(!) serial interfaces (COM ports)
- a 5 Series (or other diagnostic-capable BMW with diagnostic connector)

Equipped with these parts (I ordered them from Reichelt Elektronik (www.Reichelt.de) - that's where the order numbers come from) we can now start assembling the circuit.
First of all you need a **circuit board layout** . So you have to think about how you are going to solder the parts onto the circuit board and where you are going to put the interruptions. I came up with the following layout:



(click to enlarge)

The **BLUE** numbers mean the connection to **COM 1** , the **RED ones** to **COM 2** and the **GREEN ones** to the **DIAGNOSTIC CONNECTOR** . So let's get started: First, the breaks have to be made on the strip grid of the board. The breaks have to be made so that no short circuits occur between the parts. As you have probably already noticed, there is usually a vertical path upwards (**GREEN**) in front of a break. These are wires that also have to be soldered in. But more on that later. The breaks can be seen in the picture as small, **RED** circles. Wherever there is a **RED** circle, a break has to be made at the corresponding point on the back. Since it is easy to lose track on such a large board, I used this trick: Print out the layout in 1:1 format, i.e. the distance between the points on the grid must be exactly 2.54 mm (1/10 inch). For this purpose I have generated a FILE that only needs to be printed in the format with frame 101.6 x 162.65 mm: File for printing

- Make a hole in each corner of the printout (e.g. with a pin)

- place the printout over the front (!) of the board so that the holes of the grid are on top of each other
- fix the printout at the pierced areas with wire

There. Now things look a bit clearer. Make sure that all the holes are exactly aligned, otherwise you'll have to experiment a bit until the printout is right ;-)
To do this, hold the circuit board up to the light and see if the light shines through the holes from the back (side with the copper strips) to the front through the paper.

- Now pierce the spots with the **RED** circle (again with a pin, for example). Don't forget anyone!!!
- Turn the board over, ie you now look at the soldering side with the contact strips
- Now, if you hold the circuit board up to the light, you can see very clearly where more light (interruption) or less light (NO interruption) comes through.
- Now take a permanent marker or a similar felt-tip pen and, holding the circuit board up to the light again, mark the bright spots.

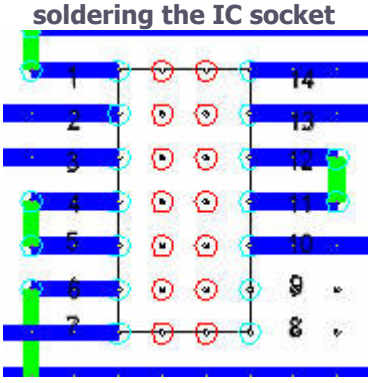
The whole point of the exercise is to transfer the interruptions from the front to the back of the board. Using the permanent marker dots, you can now place the interruptions precisely. This is done using an 8mm drill bit, which you use to drill into the board from the back until the copper strip is interrupted. (It is best to first push the pin through the board from behind at the marked points and look at the front to see if the pin really comes out at a **RED** circle). There are 55 interruptions in total. It is best to measure again at the end with a measuring device to see if the strip is REALLY interrupted.

Now comes the real part of the work.
Before we start soldering away, let's check again to make sure everything is really correct.
- Interruptions OK?
- Stripes properly interrupted?

And now let's get started:

soldering the components :

soldering the IC socket



First you have to solder the IC socket. To do this, you now use the pin we know to prick the 14 **LIGHT BLUE** dots of the IC socket from the front and insert the socket so that the notch is facing upwards. The paper can stay on the circuit board. Turn the circuit board over - and solder it in place.

Wire bridges:

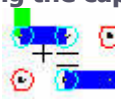
The **GREEN** lines represent wire bridges. To do this, we take any wire or strand that we hopefully have lying around somewhere at home. We first cut it to the required length and carefully strip it off at both ends. After we have twisted and tinned them at both ends, we solder it in the right places. We cut off the wires that protrude on the soldering side at the soldering holes (we always do this after we have soldered in a component).

Soldering resistors:

The same game: pierce **the LIGHT BLUE** dots, bend the resistors on both sides so that they fit, push

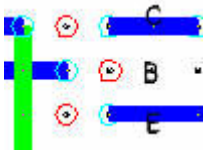
them through the **LIGHT BLUE** dots and solder them in place.

Soldering the capacitor:



The capacitor is a polarized electrolytic capacitor. This means that the plus and minus must not be swapped around. The electrolytic capacitor has a marking on the side (grey with a minus sign on it). This is the negative pole. On the layout, this is the lower pole. It also runs to ground.

Soldering transistors:



The transistors also have to be soldered in the right way. The connections on the layout are called from top to bottom: C (collector), B (base), and E (emitter). You can easily determine which is where: hold the transistor so that the legs point towards you. The flattened side part points to the left, like a D: The connections are now called from top to bottom: E, B, C.

Here is a data sheet to make sure it is really correct:
http://www.fairchildsemi.com/ds/BC/BC547C.pdf

Soldering the cable to the PC:

We cut our wire into 3 pieces: two 4-meter pieces and one 2-meter piece. Then we remove the overall insulation at the end of the cable over a length of about 5 cm and cut away the shielding. Now we see 6 cables. Which one we use is a matter of taste, the main thing is that the assignment on the COM plug and on the diagnostic socket is correct in the end.
After we have cut them to the right length (just insert them into the solder lugs of the SUB-D socket to see if they are too long), we solder the cables to the individual solder lugs on the socket. Next to each solder connection there is a small number: the pin number. Cables are only soldered to pins 2, 3, 5, 7 and 8, the remaining pins are not needed. To quickly see later which wire was soldered to which pin, we write down the pin number and the corresponding color of the cable in a table:

For **COM 1** :

PIN number	Color
2 (COM 1)	
3 (COM 1)	
5 (COM 1)	
7 (COM 1)	
8 (COM 1)	

For **COM 2** :

PIN number	Color
2 (COM 2)	
3 (COM 2)	
5 (COM 2)	
7 (COM 2)	
8 (COM 2)	

Installing the connector housing

To do this, we screw the two-part clamp onto the cable using the two matching screws. This serves as strain relief. Now we insert the SUB-D socket into one half of the housing, fiddle the cable in so that the strain relief clamp is in the space provided. Then we place the other half of the housing on top and hold both halves pressed together. We insert the two fastening screws into their place while slightly opening the two halves of the connector housing. Now we can finally screw the connector shut using the two screws and nuts.

Solder the cable with the attached SUB-D socket to the circuit

To do this, we need the table above, where we have entered the colors of the individual wires. This also shows which wire goes to which connection point on the circuit board. First, we remove the insulation from the cable over a length of about 5 cm, cut away the shielding over this length, and strip the insulation from the wires. After twisting and tinning, we can solder the wires into the right places on the circuit board. To do this, we look at the table. For example, if we have soldered the brown cable to pin 2 of **COM 1** , we now know that we have to solder the brown cable to connection **pin 2 (BLUE!!!!)** on the circuit board, and so on.

Soldering the cable to the BMW

The same applies to the diagnostic connector, but with the restriction that we do not have a SUB-D socket here, but have to help ourselves with a few nails, garden wire or something similar to which we solder the wire (don't forget to label it at the end)!!

For the **DIAGNOSTIC CONNECTOR** :

PIN number	Color
15 (Diag.)	
16 (Diag.)	
19 (Diag.)	
20 (Diag.)	

insert IC

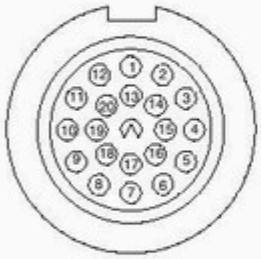
Finally, insert the IC 4069 into the socket. Be careful not to bend the legs. The notch must point upwards, as pin 1 is located top left next to this notch.

The interface is now ready. It is best to put it in an old shoe box so that it remains insulated. Lead the cables out to the side.

Let's move on to the next step:

The software

We are working with the software Carsoft 3.4.
You can get it from the manufacturer www.carsoft.be.
Please no more inquiries about where else you can get the software...



Kammer-nummer	Klemme	Bezeichnung	Leitungsfarbe
1	TD	TD–Signal	SW
2	CANH	CANCA-High (M3)	SW
3	CANL	CANCA-Low (M3)	GE
4	Schirm	Abschirmung CAN–Leitung (M3)	
5	–	Nicht belegt	
6	TACHO A	Tachoausgangssignal	SW/WS
7	SI	Service–Intervallanzeige	WS/GN
8	–	Kompressor	SW/GR
9	–	Kompressor verzögern	SW/BL
10	–	Zusatzlüfter	SW/RT
11	–	Nicht belegt	
12	61(D+)	Ladeleuchte	BL
13	–	Nicht belegt	
14	30	Batterie +	RT
15	RXD	Diagnose–Datenleitung	WS/GE
16	15S	Spannung bei Zündung EIN	GN/WS
17	TXD II	Diagnose–Datenleitung (4–Zyl. Benziner)	WS/VI
18	PGSP	Programmierleitung	WS/GN (GN/BL** G
19	31	Masse	BR (BR/OR**)
20	TXD	Diagnose–Datenleitung	WS/VI

*Diesel
**6–Zyl. Benziner

(click to enlarge)

The drawing above shows which connection goes where. If you have done everything correctly, Carsoft will read the ZKE and the DME.