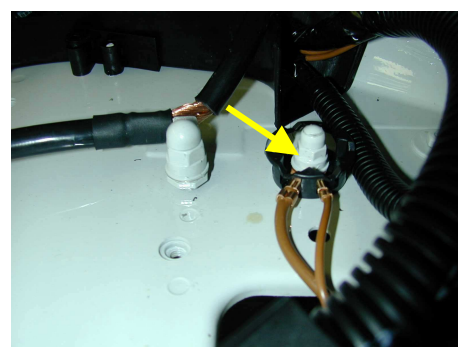
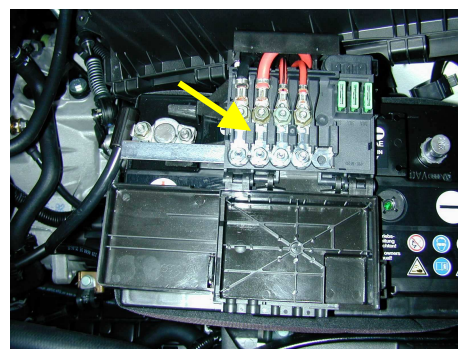
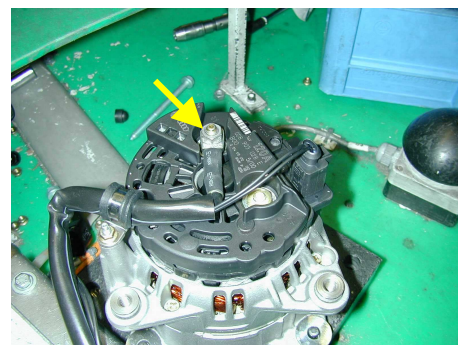




Troubleshooting

Earth (31) – often ignored

Loose or oxidised earth connections lead to malfunctions on electric and electronic components again and again. Particularly affected are the areas outside the vehicle interior such as: alternator, starter, battery, ABS, ignition and injection system (engine electronics). The lighting system can, however, also be affected. Diagnosis usually starts by testing the voltage supply. But the opposite connection (earth) to the body, to the engine or to the battery is often paid little attention. This is just as important, however. Even minor soiling of connections or joints can have significant consequences. The formation of contact resistances can lead to drops in voltage and leakage currents. These lead to malfunctions and incorrect diagnoses. For this reason, earth connections must be checked for a tight fit and cleanness. They should be bright and free of dirt, paint and oxidation. There are special contact sprays available as protection. In addition, the cable ends fastened to the plugs and eyelets must be checked. These may have become loose due to temperature fluctuations and vibrations. Water penetrating the cable can lead to "inner corrosion" and the faults connected with this. A test of resistance using the multimeter is just as much a part of the testing scope as the measurement of the drop in voltage (under load if possible). The following overview provides some key information about cable resistances, cross-sections, maximum constant current and drops in voltage:





Cable cross-section mm ²	Max. resistance/m (20 °C) mΩ/m	Permissible constant current A
1	18.5	10
1.5	12.7	20
2.5	7.6	25
4	4.71	35
6	3.14	50
10	1.82	65
16	1.16	85
25	0.743	120
35	0.527	160
50	0.368	200
70	0.259	250
95	0.196	300
120	0.153	350

Maximum permissible drops in voltage in the 12-volt vehicle electric system (examples)

Starter	Alternator	Lighting
Starter housing to body or to engine block: 0.1 V	Alternator housing to body or to engine block: 0.1 V	Loss of voltage on positive cable and (in the entire circuit): from light switch terminal 30 to bulbs <15 W: 0.1 V (0.6 V)
Battery negative to body or to Engine block: 0.2 V	Battery negative to body or to engine block: 0.2 V	from light switch terminal 30 to bulbs >15 W: 0.5 V (0.9 V)
Battery negative to Starter housing: 0.3 V	Battery negative to Alternator housing: 0.3 V	from light switch terminal 30 to headlights: 0.3 V (0.6 V)
Battery positive to main current connection for starter: 0.5 V	Battery positive to main Current connection for alternator 0.4 V	
Main current connection for starter under load (when starting): 3.5 V		
Ignition switch to the control current connection for starter: 1.5 V		

* = Open-circuit voltage of the battery in the case of all testing work at least 12.4 V