Earth (31) – troubleshooting

Data sheet	
Please note	Diagnostics usually starts by checking the power supply. In this process, the opposite connection (earth) to the body, engine or battery is often not paid enough attention. However, this connection is just as significant

Important safety note

Technical information and practical tips have been compiled by HELLA in order to provide professional support to vehicle workshops in their day-to-day work. The information provided on this website is intended for use by suitably qualified personnel only.

Earth (31) – frequently neglected

Particularly affected are the areas outside the vehicle interior, such as the alternator, starter, battery, ABS, ignition and injection system (engine electronics). However, the lighting system may also be affected.

Diagnostics usually starts by checking the power supply. In this process, the opposite connection (earth) to the body, engine or battery is often not paid enough attention. However, this connection is just as significant. Small amounts of dirt on terminals or connections can already have significant consequences. A formation of contact resistance can lead to voltage drops or leakage currents. These may lead to malfunctions or incorrect diagnoses.

For this reason, earth connections are to be checked to ensure that they are secure and clean. Their metal should be clean, bright and free from dirt, paint and oxidation. Special contact sprays are available for protection. Also the cable ends secured to the connector and eyelets are to be checked. These may have come loose as a result of temperature fluctuations and vibrations. Water that has penetrated the cables may cause “internal corrosion” resulting in the associated malfunctions.

Measuring the resistance using a multimeter thus also forms part of the scope of testing as does measuring the voltage drop (if possible under load).

The following overview provides some reference points for cable resistance, cross sections, maximum continuous current and voltage drops:

Cable cross-section	Max. resistance/m (20 °C)	Permissible continuous current
mm²	mO/m	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	150
95	0.196	300
120	0.153	350

Maximum permissible	Voltage drop inim	12 Volt vehicle electrical system (an example)
Starter	Alternator	Lighting
Starter housing to body or engine block:	Alternator housing to body or to engine block:	voltage loss at positive cable and (in overall circuit):
0.1 V	0.1 V	
Negative battery terminal to body or to engine block:	Negative battery terminal to body or to engine block:	from light switch at terminal 30 to bulbs < 15 W:
0.2 V	0.2 V	0.1 V (0.6 V)

Negative battery terminal to starter housing:	Negative battery terminal to alternator housing:	from light switch at terminal 30 to bulbs > 15 W:
0.3 V	0.3 V	0.5 V (0.9 V)
Battery Plus to main power connection starter:	Battery plus to main power connection alternator	from light switch at terminal 30 to lamps:
0.5 V	0.4 V	0.3 V (0.6 V)
Starter's main power connection under load (when starting):		
3.5V		
Ignition switch to control current connection starter		
1.5 V		

* = Open-circuit voltage of the battery at least 12.4 volts for all test work







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