Haynes shows you how

BMW 3-Series and Z4 (99-05) Includes 2006 325ci/330ci Coupe and Convertible models Haynes Online Manual.

2 Electrical troubleshooting - general information

Caution:
The electrical system is extremely complex. Many of the ECMs are connected via a “Databus” system, where they are able to share information from the various sensors, and communicate with each other. For instance, as the automatic transmission approaches a gear ratio shift point, it signals the engine management ECM via the Databus. As the gearchange is made by the transmission ECM, the engine management ECM retards the ignition timing, momentarily reducing engine output, to ensure a smoother transition from one gear ratio to the next. Due to the design of the Databus system, it is not advisable to backprobe the ECMs with a multimeter, in the traditional manner. Instead, the electrical systems are equipped with a sophisticated self-diagnosis system, which can interrogate the various ECMs to reveal stored fault codes, and help pin-point faults. In order to access the self-diagnosis system, specialist test equipment (fault code reader/scanner) is required.

Note:
Refer to the precautions given in “Safety first!” and in Section 1 of this Chapter before starting work. The following tests relate to testing of the main electrical circuits, and should not be used to test delicate electronic circuits (such as anti-lock braking systems), particularly where an electronic control module (ECM) is used.

A typical electrical circuit consists of an electrical component, any switches, relays, motors, fuses, fusible links or circuit breakers related to that component and the wiring and connectors that link the component to both the battery and the chassis. To help you pinpoint an electrical circuit problem, wiring diagrams are included at the end of this Chapter.

Before tackling any troublesome electrical circuit, first study the appropriate wiring diagrams to get a complete understanding of what makes up that individual circuit. You can often narrow down trouble spots, for instance, by noting whether other components related to the circuit are operating correctly. If several components or circuits fail at one time, chances are that the problem is in a fuse or ground connection, because several circuits are often routed through the same fuse and ground connections.

Electrical problems usually stem from simple causes, such as loose or corroded connections, a blown fuse, a melted fusible link or a failed relay. Visually inspect the condition of all fuses, wires and connections in a problem circuit before troubleshooting the circuit.

If test equipment and instruments are going to be utilized, use the diagrams to plan ahead of time where you will make the necessary connections in order to accurately pinpoint the trouble spot.

For electrical troubleshooting you'll need a circuit tester or voltmeter, a continuity tester, which includes a bulb, battery and set of test leads, and a jumper wire, preferably with a circuit breaker incorporated, which can be used to bypass electrical components **(see illustrations)** . Before attempting to locate a problem with test instruments, use the wiring diagram(s) to decide where to make the connections.

2.5a The most useful tool for electrical troubleshooting is a digital multimeter that can check volts, amps, and test continuity

2.5b A simple test light is a very handy tool used for testing voltage

Voltage checks

Voltage checks should be performed if a circuit is not functioning properly. Connect one lead of a circuit tester to either the negative battery terminal or a known good ground. Connect the other lead to a connector in the circuit being tested, preferably nearest to the battery or fuse **(see illustration)** . If the bulb of the tester lights, voltage is present, which means that the part of the circuit between the connector and the battery is problem free. Continue checking the rest of the circuit in the same fashion. When you reach a point at which no voltage is present, the problem lies between that point and the last test point with voltage. Most of the time the problem can be traced to a loose connection. **Note:** *Keep in mind that some circuits receive voltage only when the ignition key is in the ACC or RUN position.*

2.6 In use, a basic test light's lead is clipped to a known good ground, then the pointed probe can test connectors, wires or electrical sockets - if the bulb lights, battery voltage is present at the test point

Finding a short

One method of finding shorts in a circuit is to remove the fuse and connect a test light or voltmeter to the fuse terminals. There should be no voltage present in the circuit when it is turned off. Move the wiring harness from side-to-side while watching the test light. If the bulb goes on, there is a short to ground somewhere in that area, probably where the insulation has rubbed through. The same test can be performed on each component in the circuit, even a switch.

Ground check

Perform a ground test to check whether a component is properly grounded. Disconnect the battery and connect one lead of a continuity tester or multimeter (set to the ohm scale), to a known good ground. Connect the other lead to the wire or ground connection being tested **(see illustration)** . If the resistance is low (less than 5 ohms), the ground is good. If the bulb on a self-powered test light does not go on, the ground is not good.

2.8 Luggage compartment ground connection

Continuity check

A continuity check determines whether there are any breaks in a circuit, i.e. whether it's conducting electricity correctly. With the circuit off (no power in the circuit), use a self-powered continuity tester or multimeter to check

the circuit. Connect the test leads to both ends of the circuit (or to the power end and a good ground). If the test light comes on, the circuit is conducting current correctly **(see illustration)** . If the resistance is low (less than 5 ohms), there is continuity; if the reading is 10,000 ohms or higher, there is a break somewhere in the circuit. The same procedure can be used to test a switch, by connecting the continuity tester to the switch terminals. With the switch turned on, the test light should come on (or low resistance should be indicated on a meter).

2.9 With a multimeter set to the ohm scale, resistance can be checked across two terminals - when checking for continuity, a low reading indicates continuity, a very high or infinite reading indicates lack of continuity

Finding an open circuit

When diagnosing for possible open circuits, it is often difficult to locate them by sight because the connectors hide oxidation or terminal misalignment. Merely wiggling a connector on a sensor or in the wiring harness may correct the open circuit condition. Remember this when an open circuit is indicated when troubleshooting a circuit. Intermittent problems may also be caused by oxidized or loose connections.

Electrical troubleshooting is simple if you keep in mind that all electrical circuits are basically electricity running from the battery, through the wires, switches, relays, fuses and fusible links to each electrical component (light bulb, motor, etc.) and to ground, from which it is passed back to the battery. Any electrical problem is an interruption in the flow of electricity to and from the battery.

Connectors

Most electrical connections on these vehicles are made with multi-wire plastic connectors. The mating halves of many connectors are secured with locking clips molded into the plastic connector shells. The mating halves of large connectors, such as some of those under the instrument panel, are held together by a bolt through the center of the connector.

To separate a connector with locking clips, use a small screwdriver to pry the clips apart carefully, then separate the connector halves. Pull only on the shell, never pull on the wiring harness as you may damage the individual wires and terminals inside the connectors. Look at the connector closely before trying to separate the halves. Often the locking clips are engaged in a way that is not immediately clear. Additionally, many connectors have more than one set of clips.

Each pair of connector terminals has a male half and a female half. When you look at the end view of a connector in a diagram, be sure to understand whether the view shows the harness side or the component side

of the connector. Connector halves are mirror images of each other, and a terminal shown on the right side end-view of one half will be on the left side end view of the other half.

It is often necessary to take circuit voltage measurements with a connector connected. Whenever possible, carefully insert a small straight pin (not your meter probe) into the rear of the connector shell to contact the terminal inside, then clip your meter lead to the pin. This kind of connection is called backprobing **(see illustration)** . When inserting a test probe into a male terminal, be careful not to distort the terminal opening. Doing so can lead to a poor connection and corrosion at that terminal later. Using the small straight pin instead of a meter probe results in less chance of deforming the terminal connector.

2.15 To backprobe a connector, insert a small, sharp probe (such as a straight-pin) into the back of the connector alongside the desired wire until it contacts the metal terminal inside; connect your meter leads to the probes - this allows you to test a functioning circuit

Fuses

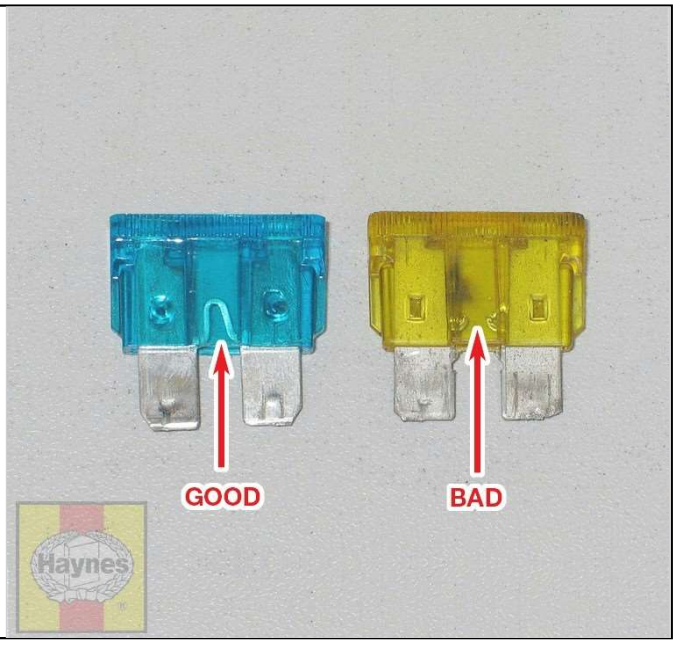
The electrical circuits of the vehicle are protected by a combination of fuses and fusible links. The fuses and relay box are located behind the passenger side glove box and in the E-box in the engine compartment **(see illustration 3.2a and 3.3a)** .

Each of the fuses is designed to protect a specific circuit, and the various circuits are identified on the fuse panel itself.

Different sizes of fuses are employed in the fuse blocks. There are regular and fuse pack sizes, with the larger fuse pack located in the E-box in the engine compartment **(see illustration 3.3b)** . The fuse pack consists of fuses that govern a variety of circuits in one assembly (DME control module, EVAP emissions valve, fuel injectors, etc.). Regular fuses require the use of pliers or the small plastic fuse-puller tool **(see illustration)** found in most fuse boxes. If an electrical component fails, always check the fuse first. The best way to check the fuses is with a test light. Check for power at the exposed terminal tips of each fuse. If power is present at one side of the fuse but not the other, the fuse is blown. A blown fuse can also be identified by visually inspecting it **(see illustration)** .

2.18a Use the tweezers provided to extract and install the fuses

2.18b When a fuse blows, the element between the terminals melts - the fuse on the left is blown, the one on the right is good



Be sure to replace blown fuses with the correct type. Fuses of different ratings are physically interchangeable, but only fuses of the proper rating should be used. Replacing a fuse with one of a higher or lower value than specified is not recommended. Each electrical circuit needs a specific amount of protection. The amperage rating of each fuse is molded into the fuse body.

If the replacement fuse immediately fails, don't replace it again until the cause of the problem is isolated and corrected. In most cases, the cause will be a short circuit in the wiring caused by a broken or deteriorated wire.

Fusible links

The wiring between the battery and the alternator is protected by a fusible link. A fusible link functions like a fuse, in that it melts when the circuit is overloaded, but resembles a large-gauge wire. To replace a fusible link, first disconnect the negative cable from the battery (see Chapter 5 , Section1). High amperage "fusible links" are located on the top face of the fuse box, while the main fusible link is located adjacent to the battery in the luggage compartment **(see illustration)** . Disconnect the burned-out link and replace it with a new one (available from your dealer or auto parts store). Always determine the cause for the overload that melted the fusible link before installing a new one.

2.21 The main fusible link is located in the luggage compartment