Controlling a Circuit

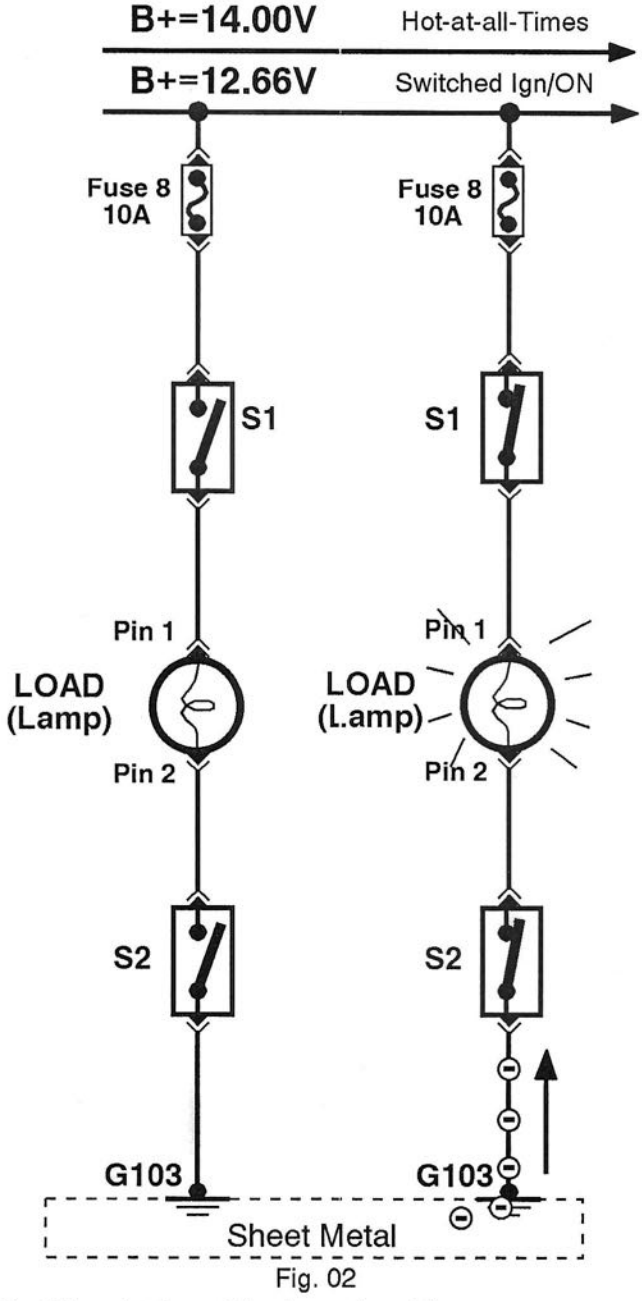

Fig. 02

POWER SYSTEM BUS (B+) WIRES

For purposes of this technical series, the Power Bus for the electrical system is shown at the left. The term "BUS" is used to indicate a positive voltage source wire that travels throughout a vehicle. The BUS voltage in our schemation for **Hot-at-all-Times** is 14.00V and labeled as B+. If the engine is NOT running, the B+ is battery voltage about 12.66V. When the engine IS running the B+ Bus voltage rises to the level of charging voltage, around 14.00V to 14.50V, depending on ambient temperature; higher voltage in cold weather and lower voltage in hot weather.

For **Switched Ign/ON** the BUS voltage is 12.66V (battery voltage at rest) and is also labeled B+. The term B+ is used in general to indicated a positive source voltage when the actual voltage can be either a high 14.50V (Engine RUN) or low 12.66V (Engine OFF) to power a circuit.

At the left are two identical lamp circuit schematics. Each circuit is connected to the same B+ BUS at the top. Each circuit is "grounded" or connected to sheet metal for B- at the bottom of the circuit. The circuit is "grounded" which means the circuit is connected to B-, the negative terminal of the voltage source. Each circuit is a seperate branch circuit of the total electrical system. All circuiits on a vehcile are connected between B+ and B- to receive electrical power to operate. All circuits are in a parallel relationship.

DUAL ON/OFF SWITCH CONTROL

Each circuit utilizes two switches to control the Lamp, the Load. Switch S1 is on the voltage side of the Load and Switch S2 is on the ground side of the Load The circuit on the left is turned OFF, because the Lamp is OFF. Notice S1 and S2 are shown OPEN, not CLOSED. The circuit on the right is turned ON, because the Lamp is ON. Notice S1 and S2 are shown CLOSED, not OPEN.

A circuit only requires one switch to control the Lamp. Why does the circuit use two switches to control the Lamp? One switch, say S1, could be labeled Master Switch. It must be CLOSED so S2 can be used to control the Lamp as needed. Heavy equipment sometimes employs a Master ON/OFF Switch which is usually switched OFF when cranking the engine for safety. Notice the direction of electron current (shown as negative charges) entering the circuit at G103.

#1. Circuit Troubleshooting Tips

When both switches are CLOSED the Lamp operates as shown in the circuit on the right. If the Lamp does not turn ON, what do you check first? Ask 10 techs and you will get 10 different approaches on what to check first. This is a simple circuit and most techs have no problem getting the Lamp to work after trying a few simple steps. I will show you a method to troubleshoot this circuit that will work best even when the Lamp is controlled by computer circuits rather than simple switches. I'll present a more complicated circuit in the next page but for now we will apply a troubleshooting procedure that will work even when the circuit contains computers. I suggest, try another lamp. Still doesn't work? Time to troubleshoot! Ask#2.

#2. What Is the Circuit Telling the Lamp?

The Lamp is prroved to be good. Next meaure the voltage at the two Lamp terminals, 1 and 2. Make sure your DMM is connected to the battery's negative terminal, called -BATT. What are good readings to expect?

Lamp Pin 1 should read about 13.0-14.5V because Pin 1 connects to a voltage (+) BUS through S1. If voltage is lower there's a bad connection due to a voltage drop. If zero volt, switch is bad or it's a broken wire connection to B+.

Lamp Pin 2 should read about 0.10V because Pin 2 connects to sheet metal ground -BATT through S2. If the voltage is greater than 0.10V there is corrosion in a wire connection along the ground circuit path. G103 could be corroded. Clean and recheck. If still too high, **CHECK ACCESSORY GROUND WIRE CONNECTING -BATT POST TO THE SHEET METAL FOR CORROSION.**

Figure 02-2025 "Controlling a Circuit"