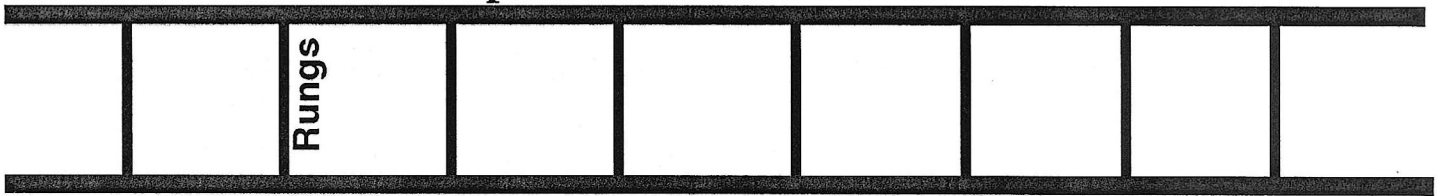


Overview of the Electrical System Read First!

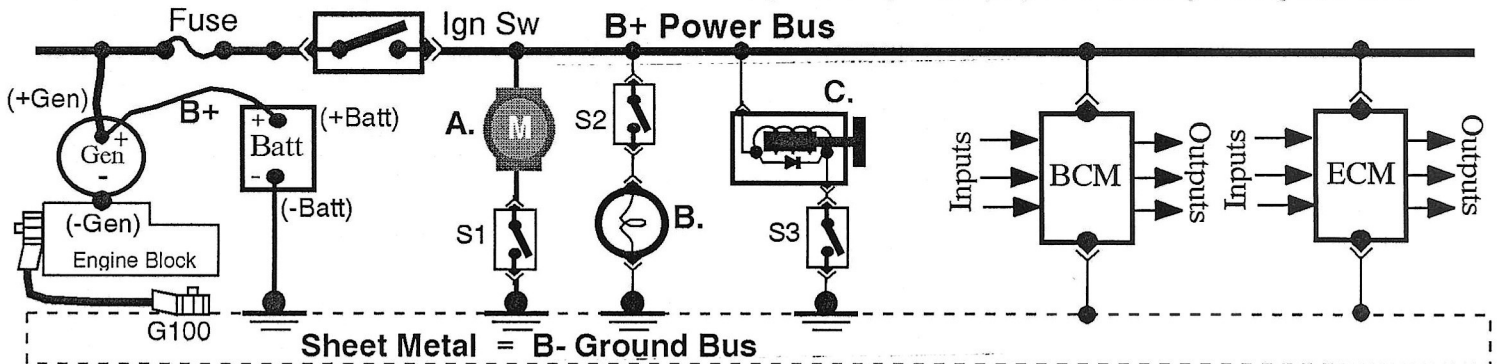
Step Ladder Vertical Side Rail



Step Ladder Vertical Side Rail

Describing a Step Ladder: The drawing above illustrates an every day step ladder used by fire departments or a home owner gaining access to the roof. A step ladder consists of two **long side rails** constructed of wood or metal. The side rails are connected together with many shorter strips of wood or metal called **rungs** giving the step ladder it's distinctive shape.

The example of a step ladder illustrates exactly how the combined electrical-electronic systems of a vehicle are wired together and helps understanding the complexities of how they all work together. Below a schematic of a vehicle's electrical-electronic system shows the two rails interconnecting all circuits to the power (B+) and ground system (B-) of a battery and generator.



① Auto Electrical Systems (B+) & (B-)

Each vehicle circuit is connected between 2 rails or Buses (+) and (-) like rungs in a ladder.

Top Rail or Bus is **B+** (for +V), the positive side of each circuit. It is the "HOT" Power Rail (+V) which connects back to the positive terminal of the battery and the generator's positive terminal. It has a positive voltage polarity called "**B+**," stated as "Bee Plus". See this in the schematic above.

The bottom Rail or Bus is **B-** (for -V), the negative side of each circuit. The vehicle's sheet metal becomes the entire **Ground Bus (-V)** side of the electrical system and is known as "**B-**" Stated as "Bee Minus". The negative or ground point of each circuit connects to sheet metal for it's ground connection to -V. Each circuit is said to "be grounded" when connected to sheet metal.

② Engine OFF B+:

When the engine is NOT running, B+ is provided by the battery to the positive Bus (or Rail) which is normally at 12.66V if the battery is fully charged. If the battery begins to drain as with a (key-off drain) problem, it eventually becomes discharged. Then B+ may drop as low as zero volt. At that time there is no B+ and all electrical circuits do not operate. Keep the battery fully charged up to 12.66V.

③ Top Bus "HOT" During Engine Run

When the engine is running the **generator** (correct term) for alternator, (as some call it) begins creating a **Charging Voltage (B+)**, which causes voltage in the B+ Bus (Rail) to rise in the range of 13.80-14.50V depending on engine rpm, battery condition and other factors explained in our main book "**Vehicle Electrical Troubleshooting SHORTCUTS.**" The Generator's charging voltage powers-up all electrical circuits **and** recharges a battery as long as the engine runs.

④ Bottom Bus All The Time "B-"

The bottom rail, known as "ground" connects directly to the negative terminal of the voltage source (**-Batt or -Gen**). All the sheet metal of the vehicle serves as the "**Ground Bus**" of the complete electrical system. Every circuit on the vehicle "connects to" or say "is grounded," (same as) "is connected" to sheet metal, the negative side (B-) of the main electrical system.

Notice connections of Circuits A., B., and C., in the schematic above. Circuit A is a DC Motor controlled by S1. Circuit B is a Lamp circuit controlled by S2. Circuit C is a solenoid circuit controlled by S3. All circuits are connected like rungs in an electrical ladder between B+ Bus and B- Bus. Control units connect the same way to get B+ and B- to function.

One circuit may fail but all others will still work!