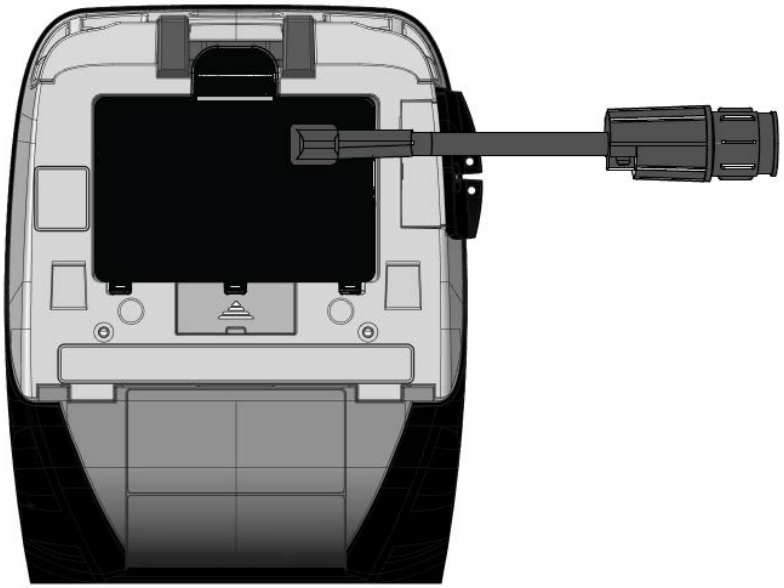
**Zebra Technologies Corporation**
1 Albion Road, Suite 100
Lincoln, RI 02865-3479 USA
T: +1 401 276 5800
F: +1 401 276 5888
www.zebra.com

# ZQ500 Series
## Battery Eliminator
## Installation Best Practices



## OVERVIEW

The mobile battery eliminator options for the ZQ500 provide power to the ZQ500 Series printer, eliminating the need to charge or swap batteries. Proper installation of the battery eliminator, as with any automotive accessory, is vital to reliable operation. The recommendations below are intended to supplement the installation instructions provided with the kit. The installer is responsible for following all warnings and cautions highlighted in the original instructions.

## TYPICAL INSTALLATION

In a typical installation, as shown below, there will be at least two devices. The interface will likely be a laptop that contains the application for the user to send a print job to the printer. The laptop and the printer will each have its own power supply to be connected to the vehicle. This installation guide covers using the ZQ500 Series printer along with a standalone battery eliminator or battery eliminator cradle.

The laptop will be connected to the printer using a USB cable, available from Zebra Technologies.

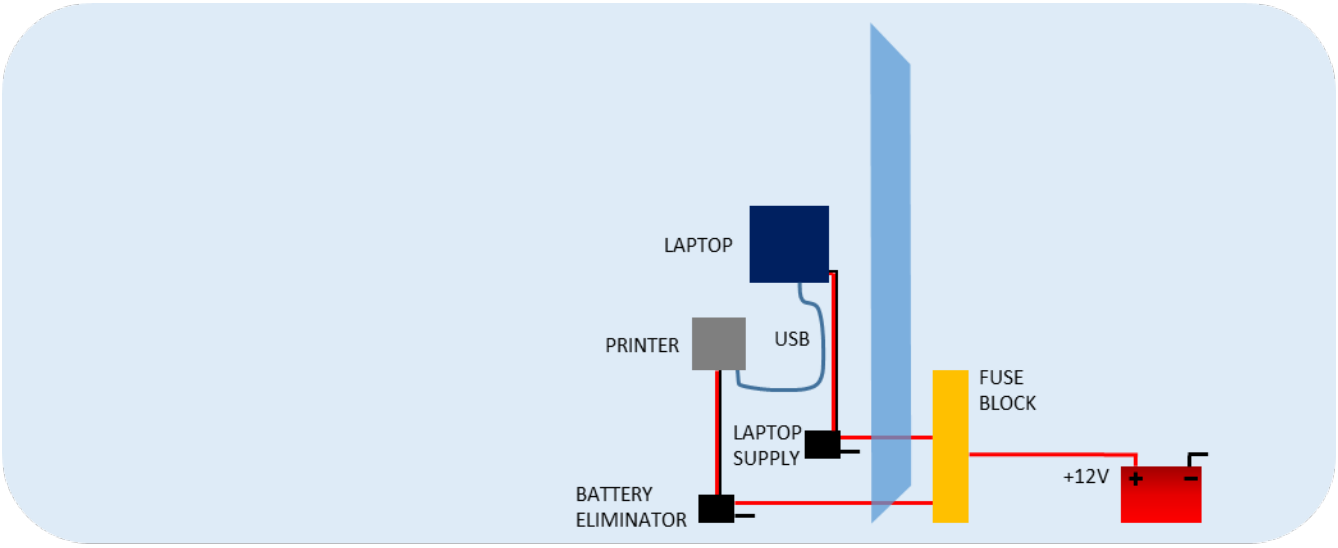



Figure 1: Typical Battery Eliminator Installation

## GENERAL AUTOMOTIVE WIRING

Typically, a vehicle will have a 12 or 24 volt system, which includes a battery and an alternator. The positive terminal of the battery will be connected to the alternator and starter of the vehicle, while the negative terminal is connected to the chassis.

When the vehicle is running, power will be supplied by the alternator. The primary use of the battery is to supply power to some systems when the engine is not running, and to support the alternator when the engine is running. It can be seen as the “flywheel” of the electrical system.

### *POSITIVE CONNECTIONS*

The positive terminal of the battery will be connected to the starter and the alternator. Other devices are sometimes connected as well, however most functions of the vehicle will receive power through a fuse block, circuit breaker, or another power distribution module (PDM).

- Any device that is connected directly to the battery should provide its own protection (fuse, circuit breaker, etc.)

Figure 2: Examples of Inline Fuse and Auto Resetting Circuit Breaker

- The connections on the positive terminal must be tight and free of dirt or corrosion.


Figure 3: Examples of a Corroded Connection and a Clean Connection

## *NEGATIVE (GROUND) CONNECTIONS*

In modern vehicles, the negative terminal is connected to the chassis of the vehicle and treated as "ground" for the electrical system. The alternator and starter may be connected directly to the negative terminal of the battery. The negative connection for all other devices should be attached to the chassis ground.

- The connection of the negative terminal of the battery to the chassis must use a heavy gauge wire of ground braid. A small wire will compromise the ground connection of all devices in the vehicle.

Figure 4: Heavy Wire Connecting to Chassis

- Connecting other devices directly to the negative terminal of the battery is a safety risk. Unless a device provides its own isolation, it is not recommended to connect directly to the negative terminal of the battery. The **Battery Eliminator** is not an isolated device and the ground wire should only be connected to the chassis, or to a ground terminal that connects to the chassis.

## *IMPORTANCE OF GOOD CONNECTIONS*

In order for all devices to work properly, they must have good positive and negative connections. One of the most common issues in automotive wiring is poor grounding. Generally, all connections must be clean and tight. Loose or dirty connections can lead to noise on communication devices or complete failure.

### *Ground Loops*

Ground Loop is a condition that exists in vehicle wiring when there are poor connections. Ground Loops exist when two or more devices are connected to a common ground through different paths. Currents flow through these multiple paths and develop voltages which can cause noise and communication errors through the USB line.

To prevent ground loops, all signal grounds need to go to one common point and when two grounding points cannot be avoided, one side must isolate the signal and grounds from the other. One method to achieve this signal/ground isolation is to install a USB Isolator between the laptop and the printer, as mentioned at the end of this document.

## WIRING RECOMMENDATIONS

The following recommendations will ensure the best possible installation for the **Battery Eliminator**.

- **Good Ground Connection**
  - Every connection to the chassis must be a good electrical and mechanical connection.

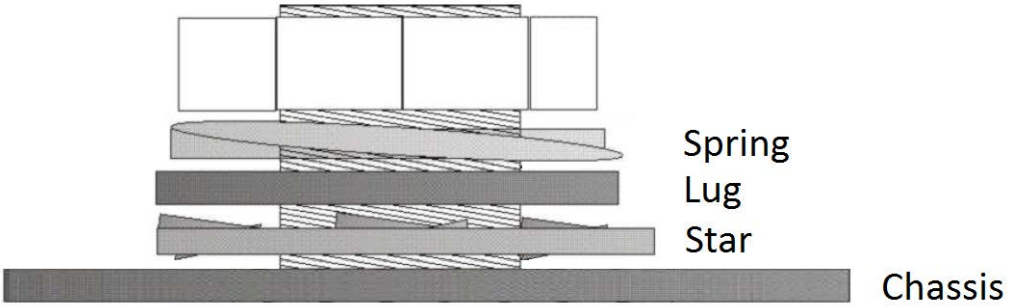



Figure 5: Ground Connection

  - Ensure that all mating surfaces are clean and free of paint or other coatings. It may be necessary to brush or scrape the surface.
  - The lug should be the appropriate size for the stud.
  - Thread-lock in the threads of the stub may reduce the quality of the connection.
  - Use of star and spring washers will ensure a good electrical and mechanical connection.
  - Dielectric grease between all surfaces may be added to prevent corrosion.

**Note:** When choosing a chassis point to connect the ground, measure the resistance from that point back to the negative terminal of the battery. The goal should be to achieve less than 1 ohm.

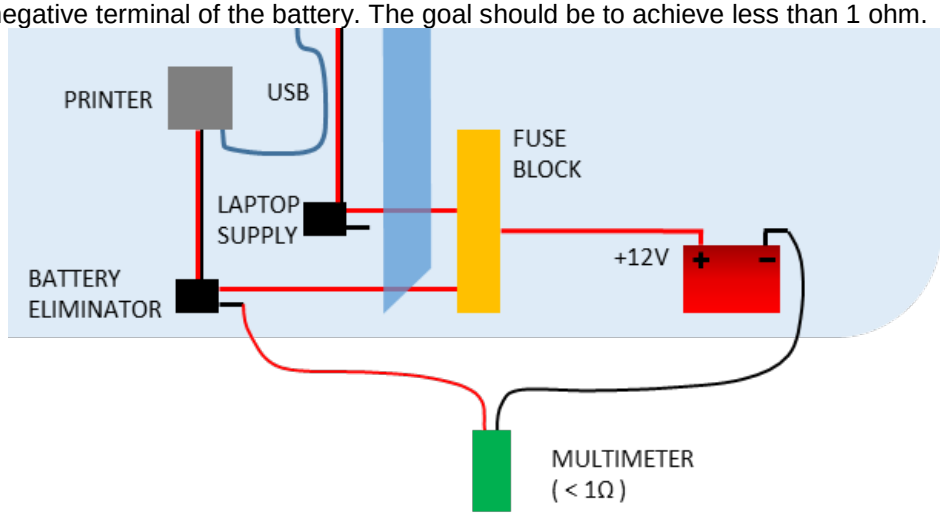



Figure 6: Measure Ground Path

- If the multimeter is not autoranging, choose a range of 200 ohms, or similar, to obtain an accurate reading.
- It is recommended to measure resistance when the vehicle if off.
- Both the laptop supply and the Battery Eliminator require good ground connections. (see the next section)
- For verification when the vehicle is running, set the meter to measure voltage and test the same path. The voltage should be close to 0 volts (less than 0.05V).

- **Common Ground**
  - It is very important to ground the laptop and the printer to the same chassis point (as close to the Negative/Ground Battery Terminal as possible) to eliminate any ground loops. If either the Laptop Inverter/Charging cable or the Battery Eliminator cable is not long enough to reach the chassis point, then ensure a heavy gauge ground wire (preferably 12AWG, with < 0.1ohm resistance) is connected from the chassis point to the ground connection wires of the Laptop Inverter/Charging module or the Battery Eliminator.

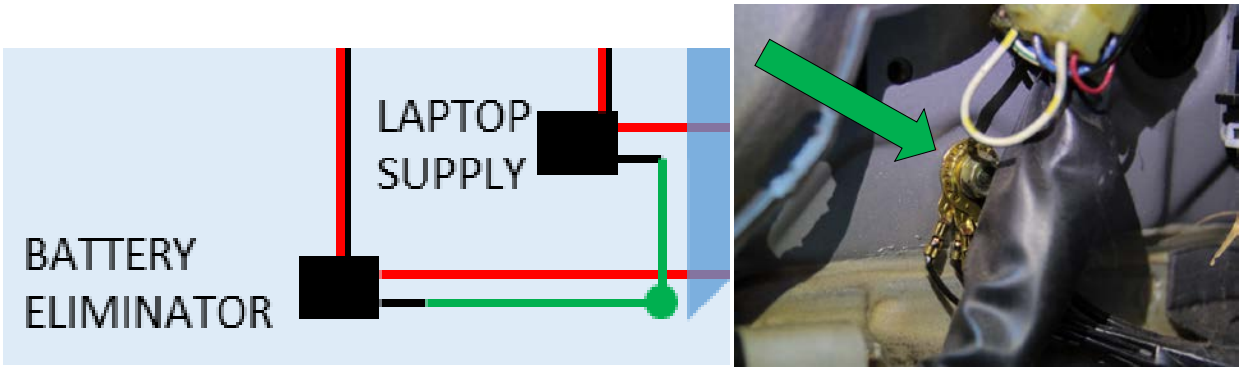



Figure 7: Connect Grounds to Common Chassis Point

- **Short Length**
  - Long wires introduce additional resistance and reduce the power supplied to the device. To ensure that devices receive full power, avoid unnecessary wire extensions and splices.
  - All ground wires should be short and connected to the nearest accessible point on the chassis.
- **Heavy Gauge**
  - When additional wiring is necessary, always use a heavy gauge, stranded wire to ensure that enough power can be supplied to the device.
  - Individual devices should have a minimum of a 12AWG or heavier supply wires. Use a separate wire for each device. Do not splice multiple leads off one wire.

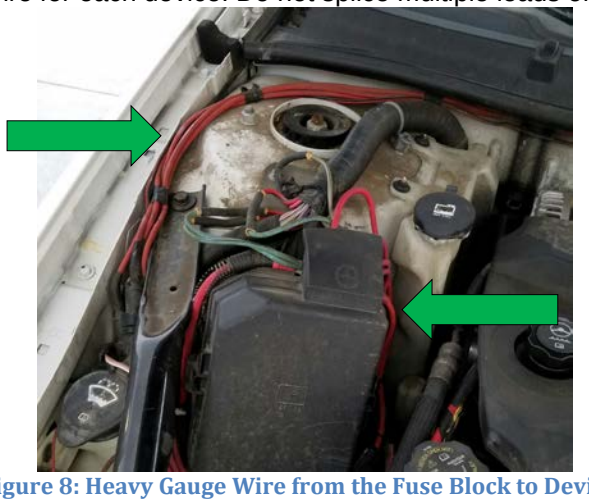


Figure 8: Heavy Gauge Wire from the Fuse Block to Devices

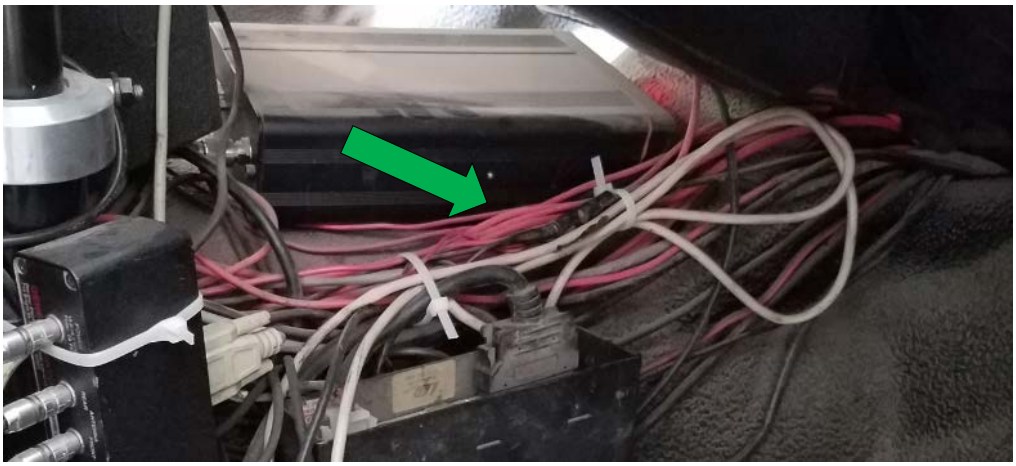


Figure 9: Example of Individual, Heavy Wires for Each Device

- Additional fuse blocks or PDM's should be supplied with a minimum of 6 or 4AWG wire.

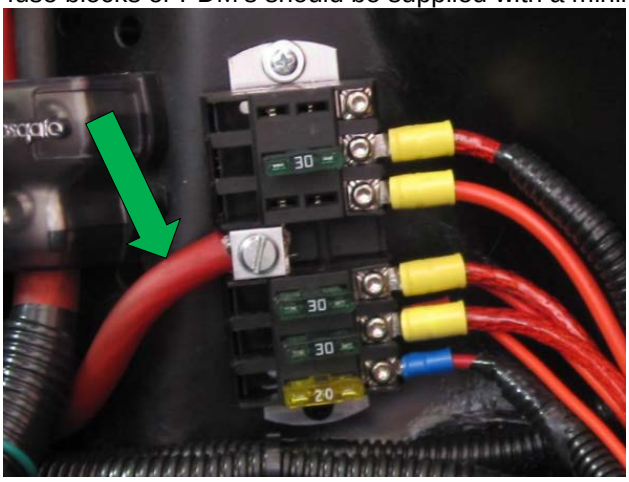



Figure 10: Example of Heavy Gauge to Power Block

- **Proper Crimping**
  - Ensure that all lugs and butt splices are the correct size for the wire gauge.
  - Crimp with the appropriate crimper for the lug.
  - When splicing wires, use a butt splice instead of quick splices.

Figure 11: Splice Options

- **Wire Ties and Sharp Bends**
  - When organizing wires and cables, tighten the wire tie until it is snug, but not too tight. This is especially important for the USB cable. Tight wire ties can reduce performance.

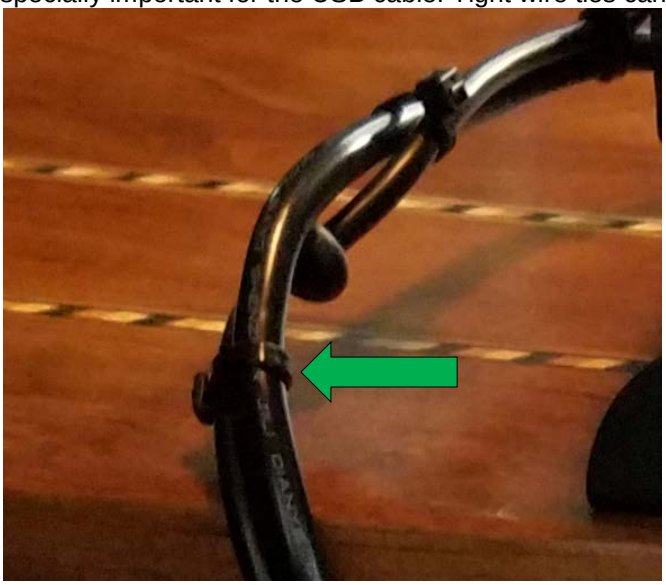


Figure 12: Snug Wire Ties

  - Do not allow wires and cables to be bent sharply, as this may cause damage and reduce performance and reliability.

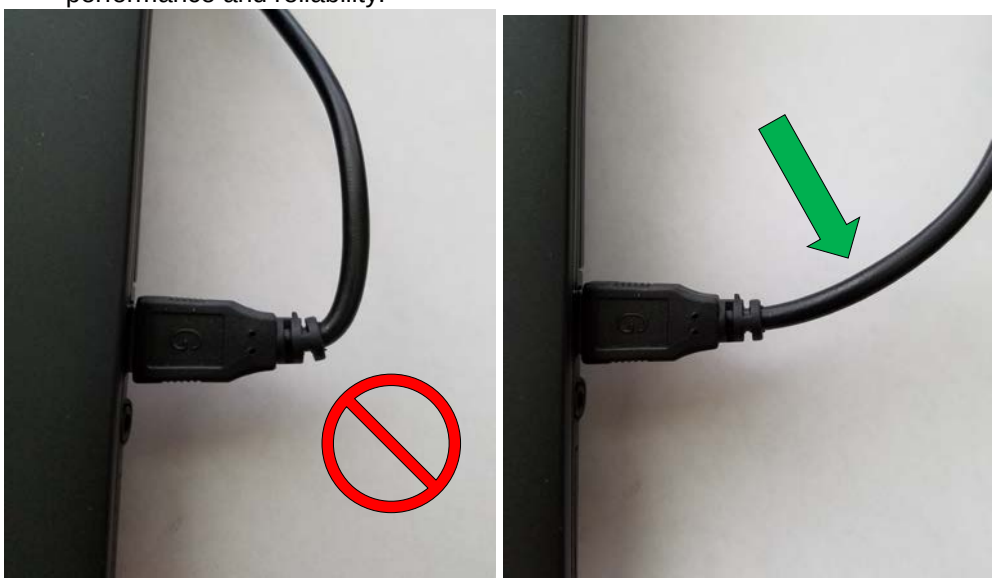


Figure 13: Avoid Sharp Cable Bends

### *Short USB Cable*

Long USB cables can introduce noise and errors leading to decreased or intermittent printer performance. Position the printer close to the laptop so that the USB cable can be as short as possible.

Figure 14: Possible Locations for the Printer

## USB ISOLATOR

In some systems, ground loops and noise may still be an issue even after ensuring that all devices are properly wired. In this case, the installer may want to install a USB Isolator.

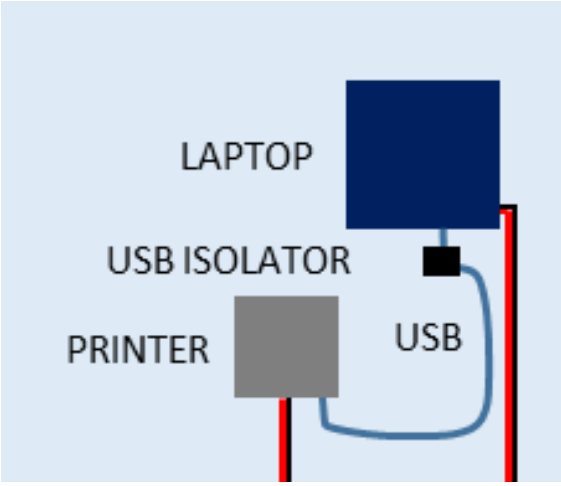



Figure 15: USB Isolator Installed Between Laptop and Printer

The SMAKN USB to USB Isolator available on Amazon.com has been found to work well for this application.