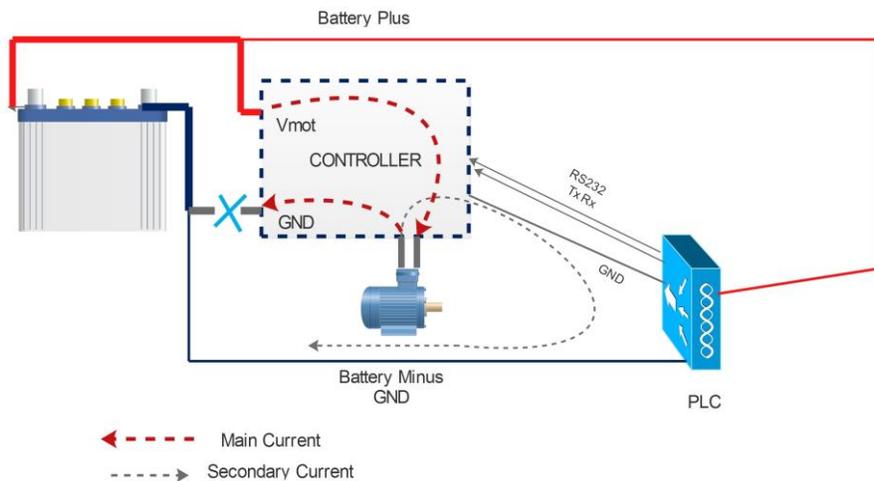


## Multiple Ground Loops

Multiple ground loops can be source of problems. Care should be exercised that secondary ground loop are not created or are not directly connected to the main battery ground in case the power ground connection is lost. In this case the full motor current would circulate in the secondary ground loop, with consequent damage to the circuitry which is not designed for large currents such as the ones that typically traverse an electric motor.

As an example let's assume that a controller is driven by a PLC via a RS232 port. The PLC is fed by the main battery via a DC/DC converter so the PLC ground is connected to the main Battery Minus ground. This creates a secondary ground loop; should the connection between battery ground and the controller power ground become loose or open, then the motor current would flow via the RS232 signal ground connection.

The figure below shows the main current flow, which exists if the ground connection is solid, as well as the secondary current that flows via the PLC ground (the DC/DC converter plus connection is omitted for simplicity). This secondary current is unwanted and needs to be suppressed.



The simplest solution is to break the signal ground loop between the PLC and controller using an isolated RS232 interface. The secondary ground loop no longer exists eliminating any possibility of secondary current via the RS232 ground. Please note that more than one additional ground loop can be introduced if connecting a PC to both the controller and the PLC via RS232 and USB ports; in this case the controller ground might connect to the PLC ground through the common ground of the PC. In this case either the power ground connection is firmly secured or every port should be isolated through an isolator.

