

# Wiring Auxiliary Outputs to Prevent Back-feeding

This document addresses the correct wiring of Link ECU Auxiliary Outputs. It comes as a result of a number of technical inquiries regarding problems wiring solenoids and relays to Auxiliary Outputs.

Incorrect wiring of solenoids and relays to auxiliary outputs can result in the following symptoms:

- ECU not powering down when the key is turned off.
- Accessories such as engine fans coming on when the key is turned off.
- Repeated clicking of relays when the key is turned off (machine gun sound!).
- ECU draining the battery over a few days.

The root cause of these problems is the wiring of hot fed (direct from the battery positive terminal) or ACC fed (key in accessory position) solenoids or relays to ECU auxiliary outputs.

Each auxiliary output consists of a low side driver and flywheeling diode. A low side driver is a power transistor that can switch a load to ground. Flywheeling diodes are required for the driving of fast switching devices such as ISC solenoids and VVT solenoids. Flywheeling diodes are also essential for reducing radio interference noise.

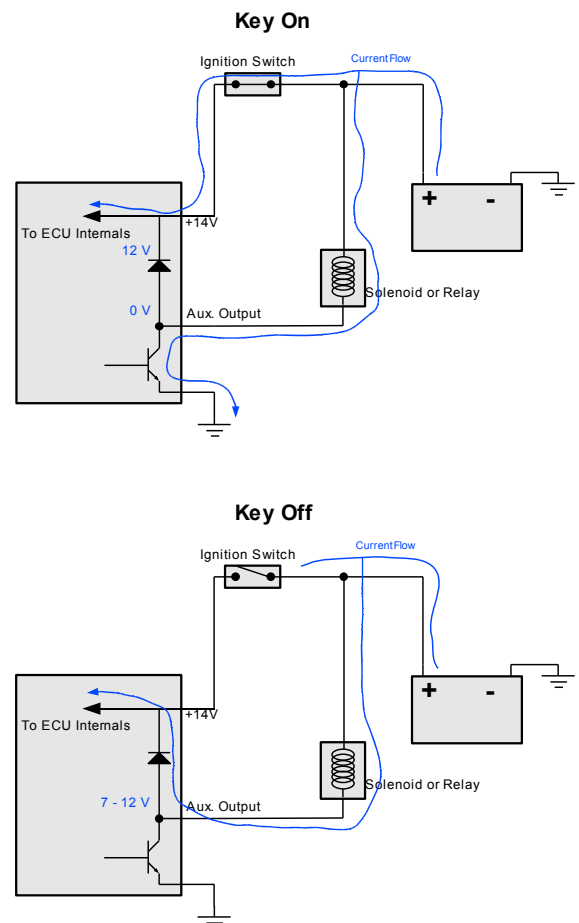
Unfortunately, the placement of flywheeling diodes means that if power is applied to auxiliary outputs through a solenoid or relay when the ECU is powered down current will flow through the flywheeling diode causing the ECU to power back up.

As solenoids have some resistance, the current that flows back into the ECU (back feeds) is not usually enough to power the ECU back up properly resulting in the ECU powering up and down continuously. This causes unusual behavior by the offending solenoid as its current is switched on and off.

The diagrams on the right shows the effect of wiring a solenoid to an auxiliary output that has its power supply wired directly to the battery. The top diagram shows the ignition switch on, the ECU powered up properly and the auxiliary output switched on. Current is being driven through the low side driver to ground and everything works as expected.

The lower diagram shows the ignition switch turned off. Note the current flow through the solenoid, into the ECU, through the flywheeling diode and back on to the ECUs power supply. This would cause the ECU to remain powered up after the ignition switch is turned off. How well it stays powered up depends on how low the resistance of the solenoid is.

**Both of these diagrams show INCORRECT wiring...**

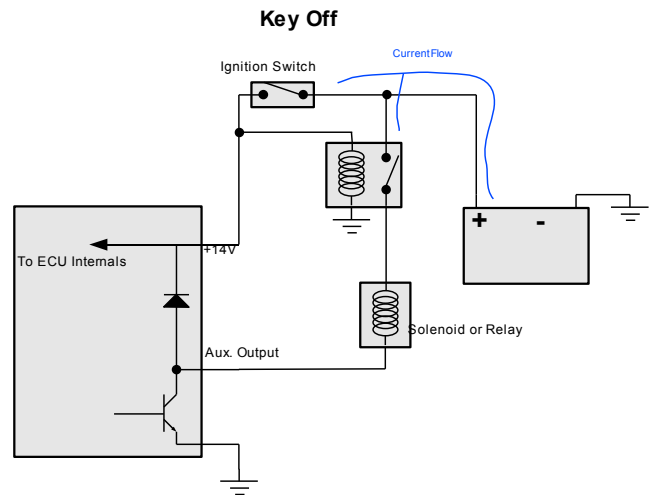
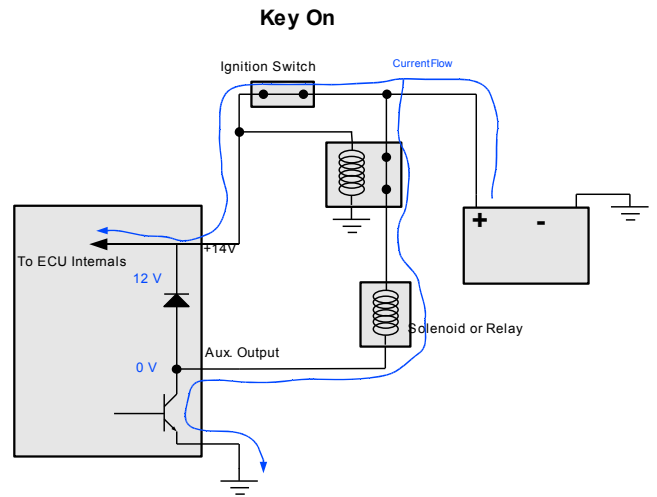


The diagrams to the right show the correct wiring of solenoids. Note that the power supply to the solenoid is disconnected when the ignition switch is turned off. This diagram shows how solenoids are wired in most vehicles and the relay would typically be the EFI main relay.

**Both of these diagrams show CORRECT wiring...**

Other notes:

- This does not apply to Auxiliary Ignition or Auxiliary Injection outputs as they do not have flywheeling diodes fitted. For that reason solenoids that require flywheeling can not be wired to these drives without an external flywheeling diode fitted. This will only usually apply to ISC solenoids.
- Engine fan relays are often fed from the ACC circuit. These should be wired to non flywheeled outputs such as Ignition or Injection channels. Alternatively their power supply should be changed to one that is disconnected when the ignition switch is turned off.
- Most Nissan ISC solenoids are hot fed.



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