

An Introduction to Split Charging

A guide to split charging

The majority of today's specialist vehicles are fitted with multiple battery banks. With the ever increasing burden of electrical loading, careful management of available charge is critical to ensure electrical reliability and safety.

Simply fitting larger charge source isn't always the answer. Abundant power still needs careful management to prevent overcharging and battery/system damage.

Blocking Diodes



A diode is an electrical component that allows current to flow one way down a cable. By building two (or more) of these into a single unit, we are able to split the charge (say from the alternator) between two or more battery banks without allowing either battery to discharge into the other. Perhaps the largest drawback of using diodes is voltage drop. When current flows through a diode, its internal resistance will lose around 0.5-1VDC of the charging voltage. This means that charging efficiency is significantly degraded unless you have a battery sensed alternator (usually done by fitting a smart alternator controller such as our Merlin AMS unit) or battery charger.

A fact that many "experts" aren't aware of is overcharging caused by blocking diodes when used with smart charging systems. This problem is caused when the batteries being charged have a large size difference- e.g (70AH engine and 400AH auxiliary battery bank). If charging a heavily depleted aux battery bank while also charging a full engine start battery, the engine battery will be overcharged. This is due to the charging device raising the voltage to around 14.8V to charge the depleted battery bank. The engine battery only needs a float charge of say 13V so it starts gassing. The problem gets worse the larger the 2nd battery gets.

The overcharging issue is prevalent on both older diodes and even with modern electronic zero loss splitters.

Split charge relays

By combining batteries during charge, and disconnecting them again during discharge, all overcharging and voltage drop issues experienced with diodes are removed (as batteries are held at a mean voltage).



Even though Split Charge Relays overcome these issues, they introduce other problems. In the event of, say, the auxiliary battery bank being flat, while running a heavy load (e.g. an inverter, motor or thruster), you will

pull high current across the relay- causing a potential fire risk. Also, if the charging source is undersized and the auxiliary battery is flat, you could easily discharge the engine battery (even though you think you are charging!)

Voltage Sensitive Relays (VSR's)

The Voltage Sensitive Relay was introduced over ten years ago. They are now standard across many vehicles. VSR's are cost effective, compact and have few drawbacks. They act like older split charge relays (which close when the ignition is switched on). But, VSR's are activated by their own internal Battery Monitoring System.

VSR's initially stay open (off) when the alternator is charging the engine start battery (therefore, the engine battery is priority charged). Once the engine battery has reached 13.7V, the relay will close allowing both engine and auxiliary battery banks to be charged together. When the engine is stopped, the voltage returns to normal levels again allowing the relay to open again- separating the engine and domestic batteries. Unlike diodes, VSR's have ZERO voltage drop (so require no battery sensing on alternator or alternator controller) and won't allow over charging. Unlike older split charge relays, they will also open if their current carrying capacity is exceeded- preventing them overheating and burning out.

A drawback of VSR's is relay chatter in a compromised electrical system. If, on closing, the auxiliary battery bank is very flat, voltage will collapse causing the VSR to open again. Voltage will then build again on the engine battery, causing the VSR to close (this cycling can happen at a quick rate). This phenomenon eventually wears out the contacts



with the VSR (however, it will not cause damage to batteries or on board electrical system parts).

VSR's are ideal for smaller electrical systems where budget is an issue.



SmartBank

While VSR's are suitable for smaller service vans, they aren't smart enough for the demands of larger electrical systems found on ambulances and where charge sources are limited compared to the size of load (relay chatter being the most regular issue). SmartBank was designed to be simply the most effective split charging system available today. Operating in a similar manner to VSR's SmartBank is Bi-

Directional. This means it senses voltage on all battery banks- allowing it to manage ALL charging sources on board. In fact you'll never need to buy a split charging device ever again! (Any charge source will charge all battery banks).

SmartBank works by monitoring both battery banks. When it sense that either battery (i.e. engine from alternator or auxiliary from a solar panel) is being charged, it will allow power to flow through to the other battery. Under no circumstances will batteries be overcharged or allowed to discharge into the other.

Relay chatter is prevented by having an adjustable connect/disconnect hold feature. It also provides the installer with the ability to ensure that the electrical charge balance between engine and auxiliaries is right for any given installation.

Unlike all other split charge devices, SmartBank's settings (connect/disconnect/hold on/hold off) are fully adjustable- this means that you can delay allowing power to other batteries. For instance, you

could ensure that the engine battery is charged almost fully before allowing power through to auxiliaries- ideal for systems where alternators/chargers are undersized. SmartBank is also fitted with an emergency parallel switch- allowing you to start your engine from auxiliaries or, use an emergency device from the engine battery if auxiliaries are flat.

SmartBank also uses DSP (Digital Signal Processing) to ensure that it isn't confused by transient voltage and noise. Further development of SmartBank is the SmartBank advanced. This combines the renowned SmartGauge Battery Monitor and SmartBank to provide the most advanced split charge and monitoring system available. As SmartGauge learns about your batteries, it automatically adjusts connect/disconnect voltages to gain maximum system efficiency while providing valuable battery monitoring information. SmartBank Advanced is available with or without SmartGauge, so existing SmartGauge users can upgrade their split charger later if preferred.