

Split Charging Fact Sheet

Many commercial vehicles are fitted with multiple battery banks. Each must be able to be discharged fully without pulling power from other battery banks while all need to be charged from the same charge source(s). While this may sound simple, it is commonly misunderstood and many legacy devices are fitted that introduce more problems than they solve:

Battery Isolators/Blocking Diodes: A diode allows power to flow only in a single direction. When two (or more) are linked between an alternator (or other charge source) and say, two batteries, they allow both to charge without allowing them to cross flow during discharge. Diodes naturally introduce voltage drop. This means that the battery does not see the correct charge voltage and never reaches 100%. What's more, diodes act like a non-return valve and cause overcharge where small and large batteries are mixed in the same system. FET/Electronic isolators and Smart alternator controllers promise to solve the voltage drop issue (which they do) but actually increase battery overcharge damage.

Split Charge Relays: Split Charge Relays are linked between the engine and auxiliary battery bank. When the ignition is switched on, they energise and parallel the batteries for charging. Charging both batteries in parallel is the best method possible (no voltage drop or force feeding). However, if the auxiliary batteries are very low and the engine is started; any high load on the auxiliary battery bank will result in large currents being drawn across the split charge relay. This results in melt-down of the relay and sometimes causes fire.

Modern split charging systems combine (parallel) batteries for split charging. No voltage drop or over-charge occurs. Built in smart control and monitoring systems prevent relay overload and in some cases are adjustable to achieve exact power balance across the electrical system.

Voltage Sensitive Relays (VSRs)/Automatic Charge Relays (ACRs): VSR's have a built in voltage monitoring circuit. When voltage is above the Connect Voltage, they parallel the batteries. When it falls below the Disconnect Voltage, they disconnect. Merlin VSRs are Bi-Directional. This means that they monitor both batteries and handle all charge sources on board. Perfect for smaller electrical systems but should be used with care on large systems and where charge sources are undersized (due to rapid cycling of the relay).

Battery Combiners/SmartBanks: Combiners work in the same way as a VSR. However, Connect Voltage and Disconnect Voltage are configurable. This allows you to ensure that engine batteries are charged properly before connecting auxiliaries. A Timed Hold delay feature prevents rapid cycling of the Split Charge Contactor on systems where very large battery banks are fitted, large loads are present or where charge sources are undersized.

Some Combiners feature an Emergency Parallel switch. When activated, this allows 'Jump Start' of the engine if the engine battery fails; Or, to allow auxiliary loads (eg VHF radio & nav equipment) to be run from the engine battery for a limited period of time. Emergency Parallel saves expensive call outs on the road and potentially dangerous situations at sea.

In Emergency Service Vehicles, adjustable split charging is crucial to vehicle reliability. Due to short journey times, quick connection of split charging is necessary (without compromising chassis electrics) otherwise no power reaches the Auxiliary batteries. Non-adjustable split chargers do not allow this. SmartBank is a perfect solution to the problem.

Battery Combiners are ideal for all applications. Multiple combiners and different combinations of Split Charge Contactors can be used to achieve complex and advanced systems. Careful placement of contactors can also determine the order in which batteries charge/discharge and prioritise them accordingly.

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	M-POWER VSR	SmartBank Lite	SmartBank Advanced	SmartBank PRO
Number of Batteries*	2	3	3	3
Continuous Current	100	125	200	200
Max Current	140	600	725	725
Connected Indicator	Yes	Yes	Yes	Yes
Ignition Protected/IP66	Yes		Yes	Yes
Bi-Directional Charging	Yes	Yes	Yes	Yes
Emergency Parallel / Jump Start		Yes	Yes	Yes
Engine Battery Capacity Sharing		Yes	Yes	Yes
Manual Adjustment of Volts/Time		Yes	Yes	Yes
Ultra Low Power Consumption**		Yes	Yes	Yes
Digital Signal Processing		Yes	Yes	Yes
PWM Contactor Control (fixed)		Yes	Yes	Yes
Adjustable PWM Control			Yes	Yes
Software Setting Adjustment			Yes***	Yes
Interface with SmartGauge			Yes	Yes
Programmable External Alarms			Yes	Yes
High Voltage Disconnect			Yes	Yes
PC DataLogging & Diagnostics				Yes
Auto Reset of PowerGuard				Yes
Multiple Inputs/Outputs				Yes
Larger Contactors Available				Yes

*Any number of split charge devices can be fitted to accommodate any number of batteries

**Units without ultra low power consumption should not be used in solar/wind applications

***Most settings are programmable through SmartGauge Remote Panel

More Battery Run-Time Without Adding Batteries!

Did you know that an average engine uses just 1 or 2 amp hours to start?

Consider a large 2.2kW starter motor. This pulls 183A at 12V per hour. However, how long does a starter motor run for? Typically just 10 seconds. So, take $183/60 = 3.05\text{Ah}$ per minute or 0.05Ah per second. 10 seconds running uses 0.5Ah . Multiply this by 2 to provide capacity required and you need just 1Ah . Most batteries need significant Ah capacity to generate the Cold Cranking Amps necessary, but in most cases there are a fair few 'spare' Ah available. So why carry spare Ah when auxiliary loads need as much power as they can get? SmartBank combiners allow you to share some of this spare Ah capacity.

Sharing Ah capacity is achieved by setting the Disconnect Voltage lower and the Disconnect Time longer than normal. We recommend setting the Disconnect Voltage at 12.5V to ensure that plenty of engine start capacity is left available. This can mean as much as several hours extra operating time of auxiliary loads. SmartBank Lite, Advanced and PRO allows this to a certain degree with their manually adjustable trim pots. For ultra controllability and fine setting to exact levels, use SmartBank PRO with the optional PC programming kit.

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