

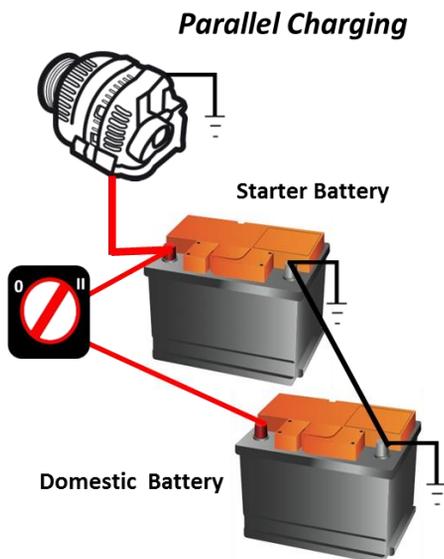
CTEK/DC DC CHARGING

What is DC DC Charging?

DC/DC charging is the charging of a secondary battery or battery bank via a direct current (DC) source such as the vehicle alternator, solar panel, wind turbine etc. This is known by a variety of names such as battery to battery, on-board charging, split charging....the list goes on.

There are different approaches to this:

Parallel Charging...

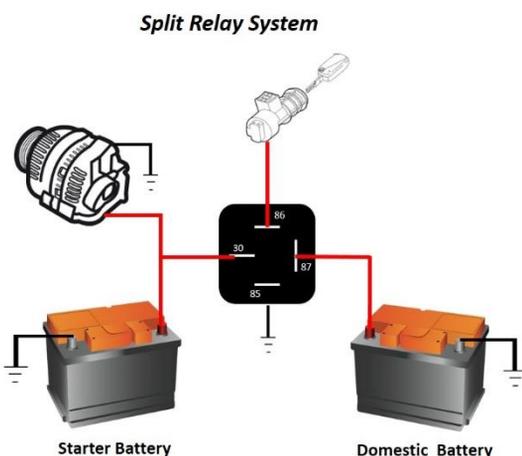


This is a very crude basic form of charging whereby the domestic (or leisure battery) is connected in parallel to the starter battery so that it can receive a charge from the vehicle alternator.

There are drawbacks to this:

- Alternator output restricts the size of battery bank as it is really only designed to charge the starter battery
- The charging / battery bank is managed by a manual cut off switch.
- There is a risk of non-start if cut off switch left on, the vehicle is parked up and domestic battery is being used, as both batteries are left connected and both will be supplying power
- Battery imbalance: batteries will not receive an equal charge using this method
- Due to this crude approach to charging, batteries will never be fully charged placing them at risk of sulphation.

Split Relay System...



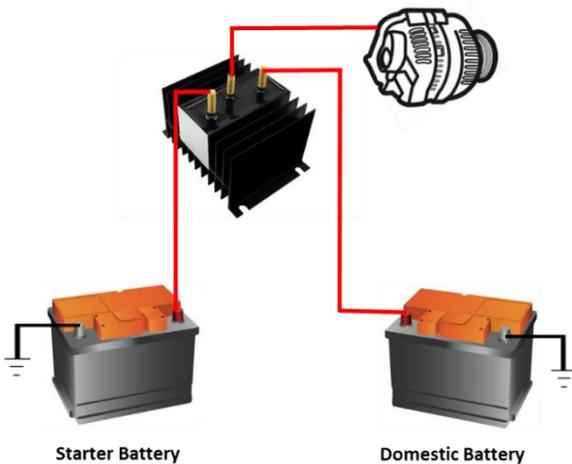
This is an improvement on the Parallel charging system whereby the manual cut off switch is replaced by an automatic relay.

There are still drawbacks to this:

- Alternator only sees the starter battery so once it considers that it has received adequate charge, it will drastically reduce the charge being delivered – this means that the domestic battery charging requirements are never met
- Once again, batteries will never be fully charged placing them at risk of sulphation.

CTEK/DC DC CHARGING

Metal Oxide Semiconductor Field Effect Transistor (MOSFET) or Vehicle Sensing Relay System (VSR)...



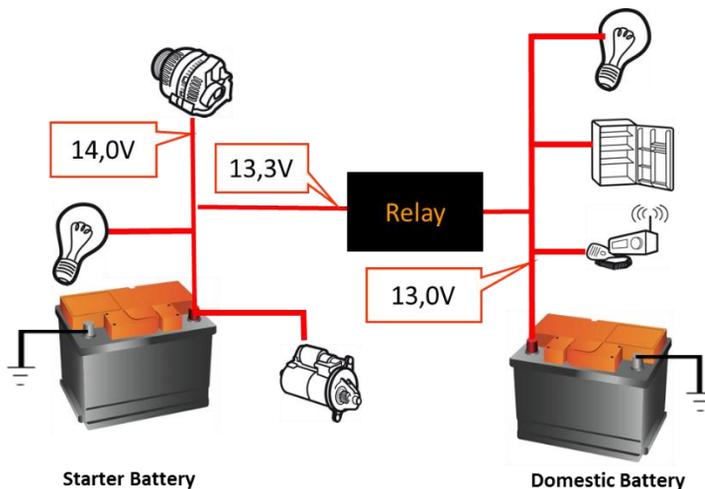
This is a fully automatic system whereby the relay will split the alternator current between the starter battery and the domestic battery.

This approach uses voltage sensing – with low voltage cut off (to protect the starter battery against charge loss via the domestic circuit) and high voltage start

There are drawbacks to this:

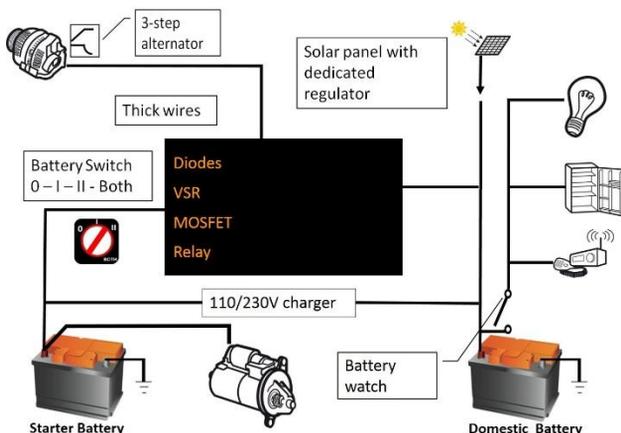
- Alternator output still restricts the size of battery bank as it is really only designed to charge the starter battery
- Batteries are still not able to reach full charge placing them at risk of sulphation.

Disadvantages of relay (or diode) systems...



- The low voltage from the Alternator, plus the voltage drop in cables makes the domestic battery less than fully charged.
- Also the charge current to the domestic battery drops the more the battery is charged, which gives a longer charging time

Disadvantages of relay (or diode) systems cont....



- Very long recharge time from alternator.
- Engine Idling just for battery charging.
- Batteries not charged to 100%
- Solar panel / alternator conflict which reduces output.
- No Charge of starter battery from solar.
- Overheated /overcharged service batteries.
- Costly, Difficult to trouble shoot, Expand, Modify...

CTEK/DC DC CHARGING

Disadvantage of relay (or diode) system...

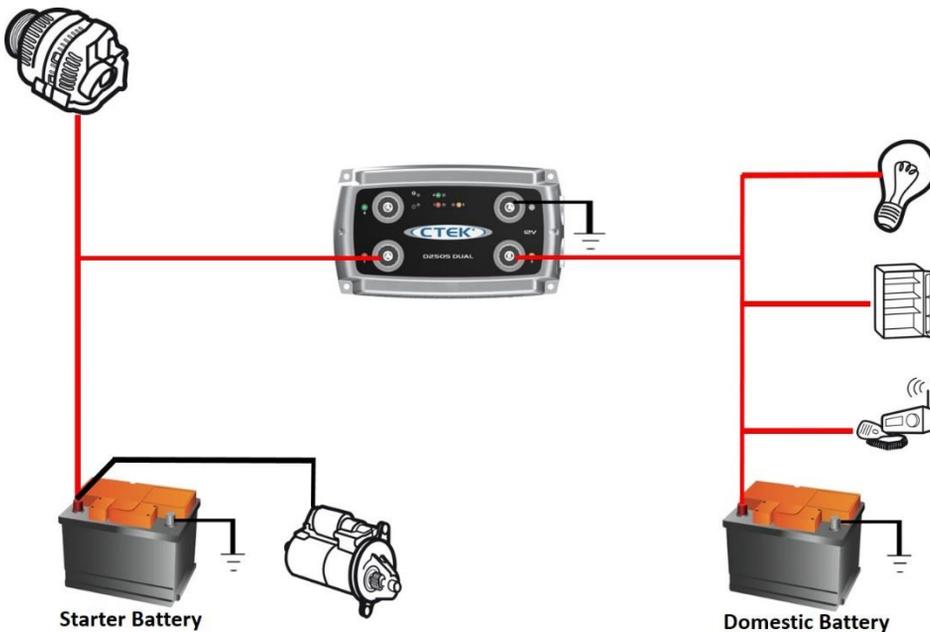
- With a relay you can never get a higher voltage on the domestic battery than on the starter battery, which means you never fully charge the domestic battery!
- The charge current drops when the level evens out between the batteries, which extends the charge time considerably.

Charging with a DC/DC charger...

DC/DC chargers such as the D250S Dual allow you to raise the voltage to the domestic battery, so that it can be 100% charged - charging current can also be kept constant, which shortens the charging time.

How does the CTEK system work?

D250S Dual is a 20A DC/DC on board charging system that will maximise the performance and increase the life of leisure batteries.

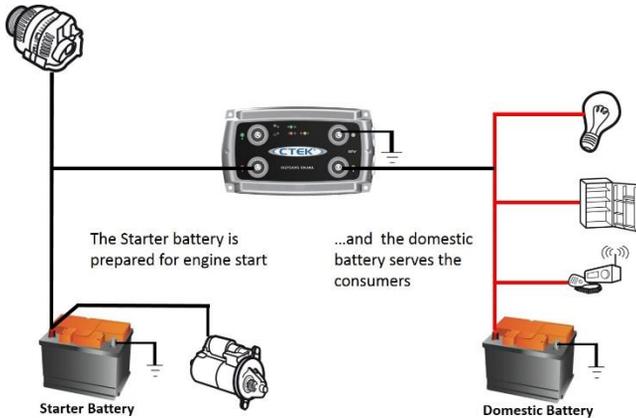


By creating a demand for 20 amps from the vehicle alternator to power the unit, the D250S Dual has the ability to deliver up to 20A of charge to the domestic battery.

SMART charge technology ensures that it doesn't damage the alternator or overcharge the battery.

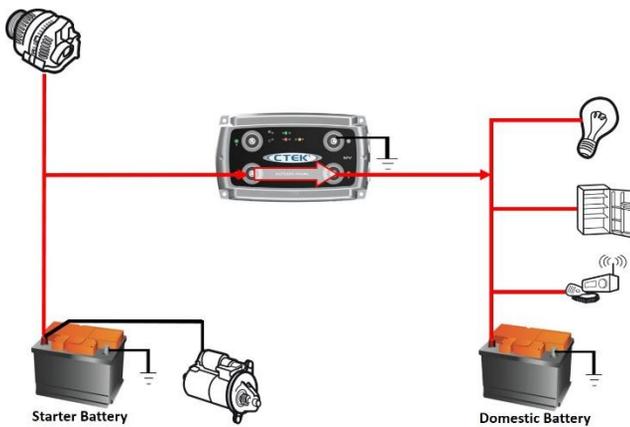
CTEK/DC DC CHARGING

When the engine is off...



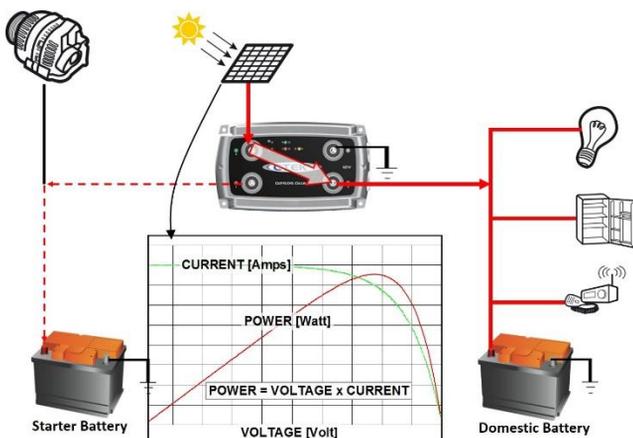
The starter battery is prepared for the engine to start and the domestic battery services consumers such as fridges, tracking devices and tail lifts.

When the engine is running...



When the domestic battery requires a charge, the D250s Dual creates a demand for 20amps from the alternator, similar to turning on the headlights.

Connecting a solar panel...



As the diagram shows, the D205S Dual has a solar panel input that compliments the charge being supplied from the alternator.

Both inputs from alternator and solar panel are harmonised by the D250S Dual to avoid any conflict and ensure optimum charge. The D250S Dual also does away with the need for an external regulator for the solar panel.

The D250S Dual uses a Maximum Power Point Tracker (MPPT) to ensure maximum performance from the solar input.

Once the domestic battery is fully charged, the D250S can deliver a pulse maintenance charge to the starter battery

CTEK/DC DC CHARGING

What is Maximum Power Point Tracking (MPPT)

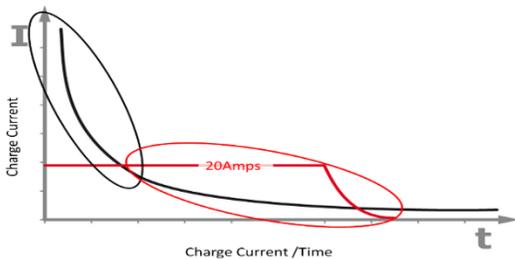
Some points for consideration:

- The D250s Dual can accept up to 22v from the solar input
- The battery will take 14.4v (a 7.6v difference)
- Performance of the panel affected by ambient temp, shade also the angle of sun, so the output is constantly variable.

MPPT is a charge controller / DCDC converter that drops the high DC solar input to a lower DC voltage for the battery.

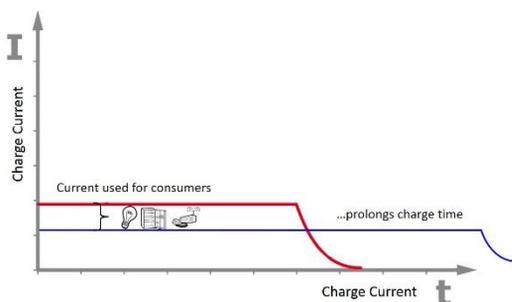
By constantly monitoring the panel output and battery requirements, the MPPT steps down the high voltage from the solar panel to a level that is slightly higher than the battery needs, always ensuring the highest possible amperage is delivered to the battery for speed of charge.

D250S Dual Limitations



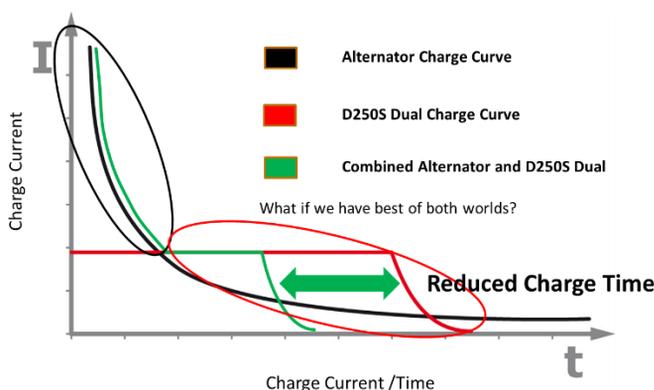
We know that upon engine start-up, the alternator delivers a high current for anything up to 30 minutes, after which current tapers off to very low level meaning that a 100% charge from alternator is almost impossible.

Over the longer period the D250S Dual (shown in red) is faster and charges to 100%.



Any consumer load on the domestic battery prolongs the charge time

What if we had the best of both worlds?



The diagram shows that whilst the D250S Dual is faster in the long run and will bring the battery up to 100% charge over a longer period of time, direct charging from the alternator could be faster on shorter journeys.

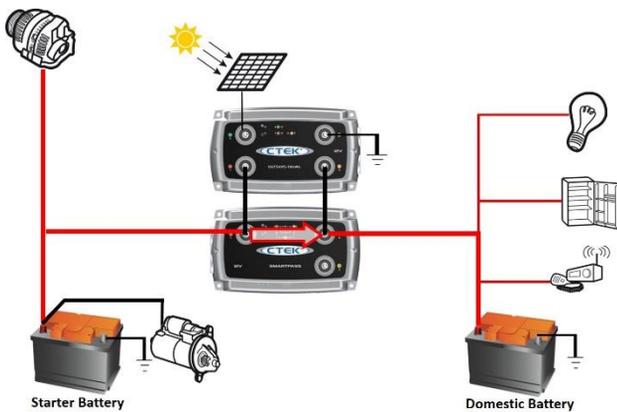
If we could combine the high output from the alternator at engine start with the constant charge rate of the D250S Dual we would be able to drastically reduce the charge time for the domestic battery.

CTEK/DC DC CHARGING

SmartPass...

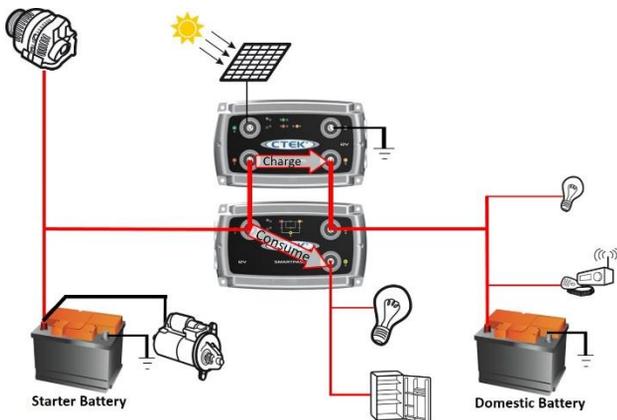
The SmartPass from CTEK is a complete Power Management unit that boosts the D250S Dual charge capability further, minimising charge time to give maximum capacity sooner. SmartPass has a charging current up to 80A for 12V batteries between 28-800Ah.

When the engine is running...



From initial start-up (13.1v) or if the consumer load exceeds 20 amps, high current is delivered through SmartPass, directly from the alternator, taking advantage of the initial higher rate of charge.

When the SmartPass detects that the alternator output has dropped below 20a or the consumer load has decreased below 20a, the D250S Dual will take over the control of charge.

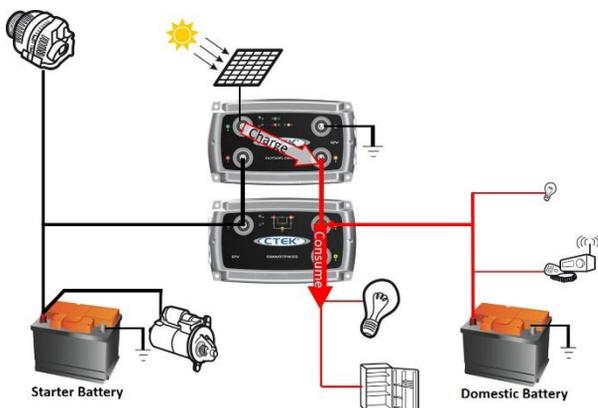


Critical consumers can be directly connected to the domestic battery.

Non-critical consumers are connected directly to the Smartpass.

The Smartpass now feeds the non critical consumers directly from the alternator.

When the engine is off...



With the engine off and no alternator feed, the Smartpass now supplies the non critical loads from the domestic battery.

CTEK/DC DC CHARGING

When the engine is off...



If the engine is off or there is little or no solar power, the domestic battery is at risk of discharge.

Smartpass will disconnect non-critical items @ 11.5v

The domestic battery and critical items are therefore protected.

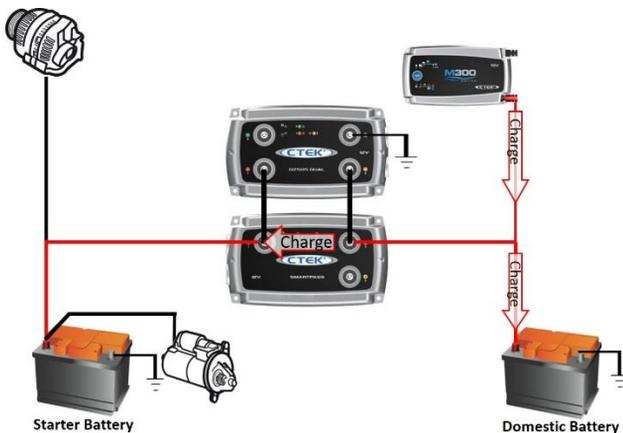
Protecting against overheating...

If the domestic battery becomes overheated due to age, oversized alternator or a high ambient temperature, SmartPass disconnects direct path from alternator.

This allows the D250S Dual to finalize the charge with reduced voltage and current



The AC/DC solution...



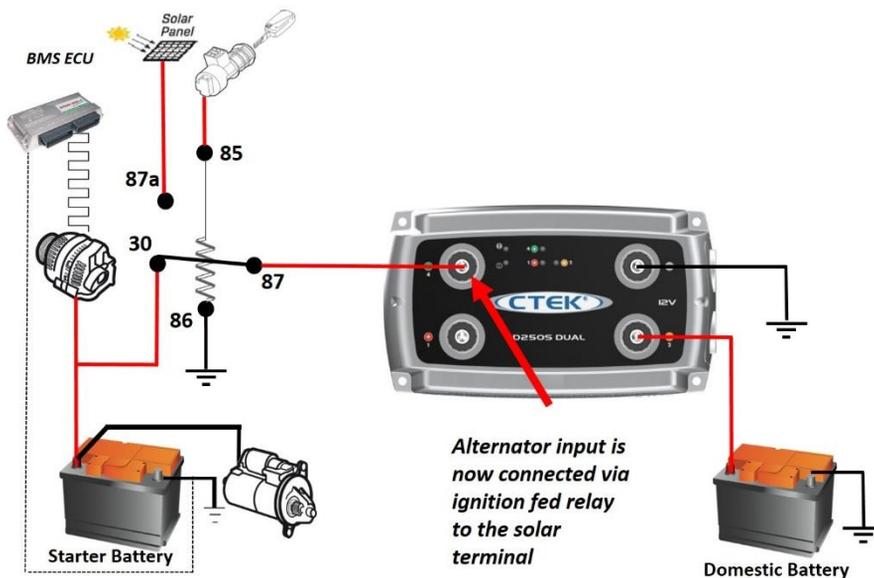
If an AC/DC charger is attached to the domestic battery, the SmartPass will detect when the domestic battery is fully charged and re-direct charge to the starter battery, enabling both batteries to be 100% charged.

CTEK/DC DC CHARGING

CTEK and smart alternators...

The starter battery terminal on the D250S Dual is voltage sensed to allow the unit to switch off when battery voltage reaches 12.8v or engine off condition, this is to prevent starter battery discharge through the D250s Dual.

On vehicles fitted with SMART alternators, problems can occur when the Battery Management System (BMS) reduces the alternators output. The starter battery voltage can drop below 12.8v, the D250S Dual sees this lower voltage as engine off and terminates the charge. There is however a solution to this:



A standard 30a 5 pin relay is used to connect the alternator input to the solar terminal on the D250S Dual unit. With engine running terminals 87 and 30 are closed allowing starter battery feed to D250s Dual. Because the solar terminal is not voltage sensed this ensures the unit continues to charge even when the battery management system has the alternator at low output.

Size makes a difference with panels...

It is important that the right size panels are selected for use with the D250S Dual to ensure optimal performance.

The wattage quoted below is for output in Ideal conditions

Panel Size	System Voltage	Output
80w	12v	6.66A
100w	12v	8.33A
150w	12v	12.5A

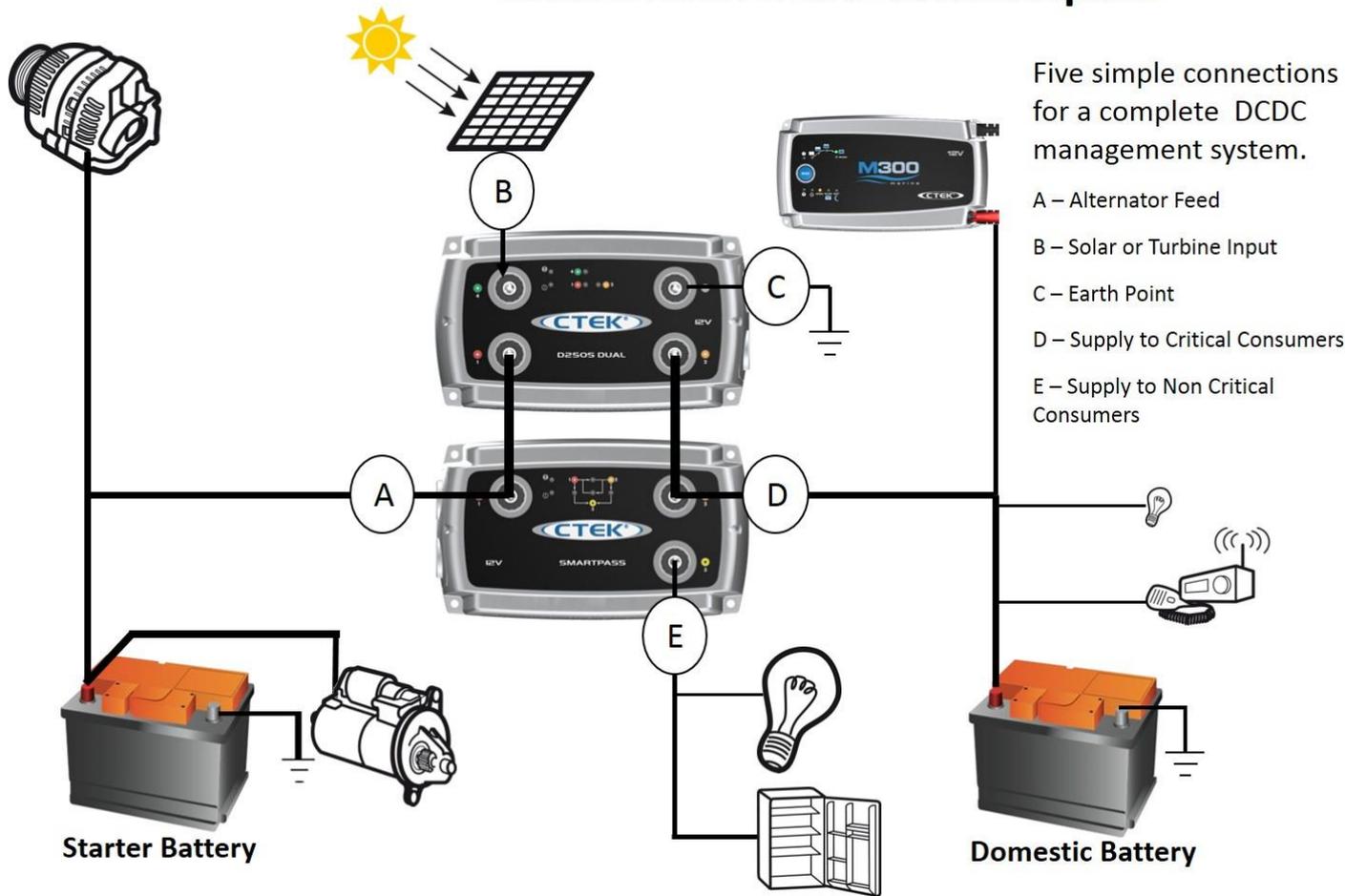
Remember that:

- Panels can be paralleled to double the Wattage /Amperage
- Temperature plays a big role in panel output
- High temperature and panel efficiency drops
- Low temperature and panel efficiency increases

CTEK/DC DC CHARGING

D250S Dual and Smartpass simple connectivity

CTEK D250S DUAL & Smartpass



Five simple connections for a complete DCDC management system.

A – Alternator Feed

B – Solar or Turbine Input

C – Earth Point

D – Supply to Critical Consumers

E – Supply to Non Critical Consumers