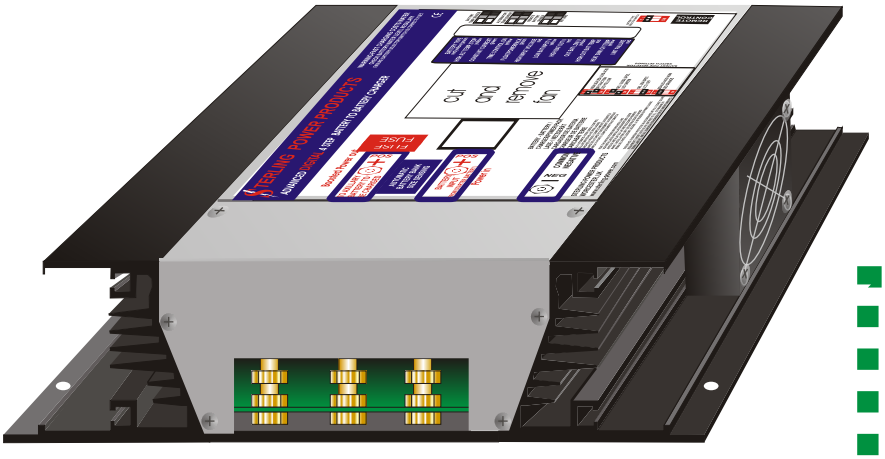
AB1290
AB12160
AB2460
AB24120

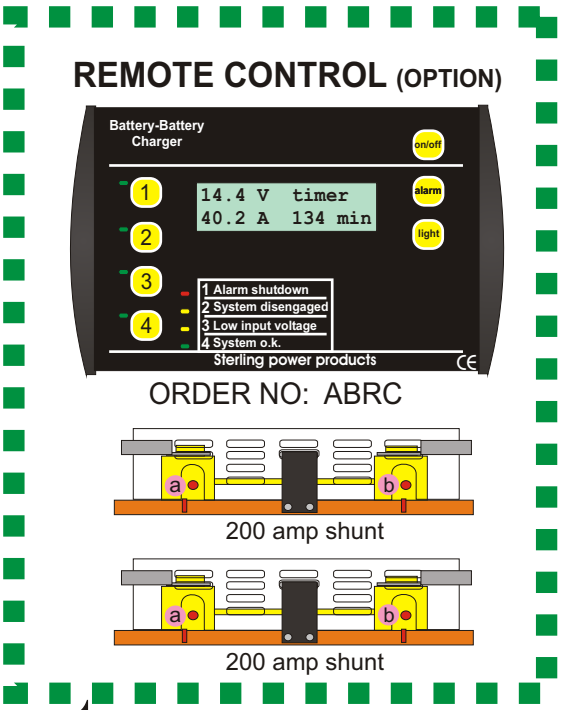
STERLING POWER PRODUCTS

ALTERNATOR - to - BATTERY CHARGER

Advanced charging technology



Pro Digital



Installations Instructions

& manual

Installations- und

Bedienungsanleitung

Advanced Digital Voltage Amplifier

10 All yellow circles with numbers on them are referenced to the installation drawing on page 5

What does it do:
This unit is a combined split charge diode system and a voltage amplifier. The unit comprises of one alternator input and two battery bank outputs. The output marked starter battery is a straight channel through a diode which has no boost function as it is the channel that must be connected to the boat/vehicle engine system , most vehicle E.C.U. systems cannot deal with a high input voltage because this would set off alarms in the E.C.U. system (engine electronic management system). The assumption we are making is that the channel marked domestic battery is independent from the engine starter system and that none of the engine management system is connected to it (a common negative is alright and essential for the system to work). The base operation of this system is very straight forward: Simply an alternator with a split charger diode system with two outputs.

The clever part:
First of all, let me explain why **the most effective way to get the most out of your alternator system is to use an 'Advanced' alternator regulator** (see the Sterling universal digital alternator regulator range). However, this is not always easy to fit, and with some modern vehicle engine management systems and warrantees it may also not be possible to fit. There are two ways to get the maximum out of an alternator: Either increase the voltage coming out of the alternator (fit an advanced alternator regulator) or pull the alternator's voltage down so that the alternator's own regulator works at full performance. Both of the above options work as far as maximising the alternator output is concerned. However, with the second option (pulling the alternator voltage down) you would find that even though you have maximised the alternator's performance as intended, you have also ended up with a voltage and current which are absolutely useless for battery charging purposes. A standard alternator is set at about 14 volts. So if we pull the voltage down to 13 volts to maximise the alternator's current, then 13 volts is no good for charging batteries fast. (Calm down, you haven't wasted your money on this thing :-)

The solution: If you pulled the voltage down and ended up with a useless voltage as described above, but thereafter amplified the voltage from 13 to 14 .8 volts and fitted a 4-step digital control system (as used by our battery chargers and advanced regulators), then you would have the benefits of pulling the alternator down as well as the benefits of the advanced regulator - all in one box.

The worry: The only concern with the above-detailed system is that it may have negative effects on the engine start battery which at the end of the day is the most important battery. We have therefore incorporated two software functions into our design which will ensure that the battery remains fully charged. The amplifier is not used for the first 2.5 minutes (the top green light will flash to show that the system is working) and even though the software is in control, it is not doing anything in order to ensure that a maximum amount of amps are fed into the starter battery which in turn allows the battery to recover in the fastest time possible. The amplified section is then switched off every 15 minutes (for another 2.5 minutes) to ensure that the engine start battery is alright. The unit (when on maximum amplification) has the ability to pull the alternator down to 10 volts which would result in the loss of the engine start system. Similarly, if you were to put a heavy load on the engine system (such as putting on the headlights of a vehicle), then you would lose the engine battery which obviously is not acceptable. In order to overcome this problem, we have therefore added a low volts regulator on the vehicle battery so that it will never go below 13 volts. Even when the alternator is completely exhausted, the engine system will always have power priority, despite the fact that the other side is much more powerful. As you can see from the graphs of an actual test run, the vehicle's battery continues to charge even when the boost is working at full power.

Installation:

The installation process is very easy. If you already have a split diode, then it's simple; if not, just follow the instructions. Install the unit in a cool, dry and well-ventilated position as it is not waterproof, and please make sure not to fit it in a box as the heat produced by the unit must be got rid of.

Program the battery type into the unit: 6 Go to the battery type, program the dip switches on the unit and set the battery type. There are three main types of battery:

NON SEALED LEAD ACID: (or sealed lead acid where you can unscrew the lid of the battery and top it up with water): This type of battery has a long life and is the best for fast charging (max voltage 14.8).

GEL / EXIDE SPECIFICATION: This is the new specification laid down by Exide for its gel batteries. Basically it is 14.4. volts for about 10-14 hourss, regardless of the state of the batteries, then it drops to float GEL/ U.S.A. SPECK. For some reason the gel is different in the U.S.A. and they have asked for a lower charge voltage of 14.1 volts at a different time setting which then drops to float.

A.G.M./sealed. This has a charger voltage of about 14.1 volts with a software timed cycle which then drops to float at about 13.5 volts. Most so-called a.g.m. batteries are in fact only sealed lead acid. Always remember that fast charging costs water, so if the battery is sealed and you cannot top up the water then do not use it for fast charging. Open lead acid batteries are best for domestic systems.
My advice is to use the open lead acid batteries wherever possible as they are also the lowest cost-avoid gel by far (the worst type of batteries are sealed/a.g.m.). Install the unit as close as possible to the alternator and batteries (taking into account the above requirements). If you need to fit it in an enclosed engine room (e.g. in a small yacht where the engine room is fully enclosed with sound proofing - where I come from this is called an oven :-), then try to install any equipment as low as possible, ideally outside the engine room near to the battery box. (On a separate note: Always remember that the only air-cooled item in the engine room is your alternator which means that if you have a totally sealed room you should not be surprised if you go through alternators on a regular basis. If the engine room is sealed, then put a vent tube from outside to the back of the alternator. This will enable the alternator to suck air through the back to cool itself and you will not experience any alternator problems.)

To install the unit:
1) Connect the main alternator output (B+) to the centre stud marked alternator input and then simply connect the other two studs, one to the engine battery and one to the domestic battery. Please ensure that the cable used can carry the full current of the alternator. It is always best to have 2 x plus the capability to reduce voltage drops, i.e. if you have a 70 amp alternator, then use a 140 amp cable.
2) The unit has a smaller negative wire which requires a 60 amp cable and should be connected directly to the alternator negative at the alternator case or negative stud. This wire is a lot smaller than the alternator cable which may sound confusing as you would think that if you had a 100 amp alternator with a 200 amp cable on the positive, then you would require a 200 amp cable on the negative (don't ask as it would take a book to explain, but just trust me that the smaller cable is alright).
3) If you already have a split charger diode, then the three positive cables are already there. Simply replace the diode with this unit and connect the negative. **see the basic installation drawing**
For the basic installation 'that's it', 'job done'. Simply switch on the engine and the software will fire up the unit, 'and away it goes'.

Extra wiring to enhance the performance of the unit

In order to improve the performance of this unit we have added extra features which all help, but are not required for the unit to work.

Battery temp: 1 Simply connect one of the enclosed temperature sensors to a battery terminal post (negative or positive) and to the two small terminals marked battery temp and the system will pick up the heat through the lead. The output voltage will be reduced in accordance with the manufacturers' battery charging temperature curves and in the event of the battery temperature increasing due to battery failure and the temperature reaching in excess of 50 deg c (major problem), the unit will switch off the amplifier. (However, the straight through path from the alternator is still connected which means that **if the problem which has caused the batteries to overheat is the failure of your standard regulator in the alternator, we will give a warning, but won't be able to stop it).**

Alternator high temp disengage: 10 This is another temp sensor (supplied) that should be connected to your alternator output post (B+) and which will disengage the amplifier in the event of the alternator reaching 100 deg c. This will not set off an audible alarm, but simply indicate the problem with a l.e.d. The remote (if fitted) will then show when the alternator has cooled down enough for the system to automatically re-engage and carry on its work.

Domestic sense: 3 The unit comes as standard with the facility to sense all the control voltages at the unit. However, if you would like to sense the voltage at the domestic battery directly in order to overcome the voltage drops in the cable run drops, then simply connect a cable from the domestic sense connection directly to the domestic battery

Starter solenoid: 4 Some alternators cannot work if there is no voltage

on their main B+ terminal which fires up the alternator. This is easy to see because when you fit a spit charge diode there is no feed on the B+ which in turn means that the engine will start, but that the alternator may not work. If this is the case, the way to overcome this is to use the starter solenoid feed. This is a simple feed that connects the terminal on the starter motor and which only becomes live when the starter motor bendix is engaged (i.e. the first two seconds of having the ignition key fully on). Then when the starter is disengaged, the point becomes dead. What actually happens is that a 12 volt feed is sent to the alternator B+ terminal for the starter duration (which is enough) and that then fires up the alternator. After this the alternator then looks after itself.

Remote control kit: 5 8 9 11 12 An optional extra with this unit is the remote control kit which comes complete with a remote display and two 200 amp shunts plus two 150 amp cable link wires.

The two shunts measure both the domestic 8 9 and the engine battery current, and the software works out the alternator current. The remote measures things such as voltages and temperatures, and in the event of a problem it does not only display what the problem is, but also what needs to be done about it.

Install shunts: for remote panel (optional extra) 15

The remote kit comes with the two shunts, plus two heavy connector cables . It is very important that the small sensor cables you need to fit are connected the right way round as otherwise the current readings will not be correct. Look at the p.c.b drawing. with the a and b markings and connect the sensor cables to the shunt in the correct position as per the drawing on the full installation drawing, use low current 3-5 amp cable

Shunt type adjustments: Internal adjustments 13 (not required as standard). This unit comes set up for the standard Sterling 200 amp shunt (1 mv = 1 amp), however, it can be re-programmed to accept a 500 amp shunt (0.1 mv = 1 amp). Make sure that you do not make adjustments unless you fully understand how to. If in doubt, please call us for help.

Low alternator regulator adjustment: 14 **(standard set switch 1 off)**

Most regulators come as standard between about 13.8 and 14.4 volts. If the standard regulator is not within its limits and has a low voltage performance of below 13.8, the unit may not work as well as it could. By switching on the switch number 1 on the regulation voltage, the engine battery is dropped from 13 to 12.8 volts which in turn improves the boost effect from the unit. ***Warning: Do not do this unless you have the above-described problem as this could result in a low engine start battery performance.***

Start-up and test procedure:

As soon as the unit is connected it senses the output voltage from the alternator, so when the alternator starts up, there will be a slow flashing of the top green l.e.d. This confirms that the unit is working (even though it remains inactive for the first 2.5 minutes to allow a little time for the engine battery to recover). After this time period the green light will discontinue flashing and display a continuous green instead. The chances are that the engine load will increase. The system is then on constant current and the unit should be boosting the current into the domestic battery bank. This high current will continue for about 15 minutes after which it will stop for 2.5 minutes in order to ensure that the engine battery is alright. Once the domestic battery reaches 13.9 volts, the trimer l.e.d. will come on and the high charge rate will continue for the time from switch on to 13.9 volts x 10, with a minimum of one hour and a maximum of six hours. The rest periods every 15 minutes for 2.5 minutes are also taken into account during this period

If on start-up nothing happens, then:

1) Test the alternator voltage. It should be about 13.8 volts, but if it isn't then the unit is at fault.

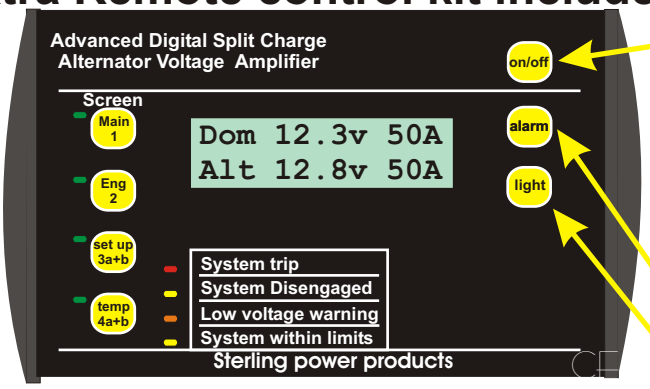
2) If the alternator voltage is below 10 volts, then the alternator is either defective, or it may not be working because it needs 12 volts on the B+ terminal for it to work successfully. To check if this is the case, simply short out between the alternator connection and one of the battery connections in order to set 12 volts up the alternator cable. If the alternator fires up and everything works, then look at the extra terminal marked Ing feed, and connect this to the starter motor solenoid engagement as per the instructions. This will shoot 12 volts up the line to fire up the alternator.

3) The unit needs about 12.6 volts on the alternator to work as failure to reach this voltage will prevent the amplifier from coming on line. However, the basic split charge diode should still be operating.

4) If there are 14 volts going into the unit and only 12.6 or less coming out, then the diodes have failed and the unit needs to be repaired.

Optional Extra Remote control kit includes parts: see page 4

- 5 **Remote Panel**
- 8 **200 amp shunt**
- 9 **200 amp shunt**
- 11 **pre made cable**
- 12 **pre made cable**



on/off: This switches off the unit boost aspect, but cannot prevent the standard diode splitting from working. The monitoring functions remain on, and the only way to know if the unit is switched off is by checking that the system within limits (l.e.d.) is off and that the boost off is on screen 3b.

Alarm: This mutes the alarm system.

Back ground light: This switches the background light on and off.

Screen1:
Push button marked Main 1. This is the main screen and the one it is best to leave the unit on. It shows the domestic battery voltage and current as well as the alternator output current and voltage

```
Dom 12.3v 50A
Alt 12.8v 50A
```

Screen2:
Push button marked Eng 2. This shows the engine battery voltage and current. It also shows the time calculation for the high charge rate and the count down to the float charge.

```
Start 12.7 4A
Timer: 134 m
```

Screen 3a:
Push button marked Setup 3 a+b: There are two screens on this button. Push once for screen 'a', then once again for screen 'b'. Screen 'a' shows the system setup, e.g the system is a 12 v system and the battery type selector is for wet (conventional lead acid). This refers to the domestic battery only.

```
System set:12v
Bat Type : Wet
```

Screen 3b:
Push button marked Setup 3a+b: There are two screens on this button. Screen 'b' shows the effective boost being delivered at this time and ranges from 0% (during the rest periods and on float) to 100% when system on full power.

```
Alt Controller
Power 13% Bost
```

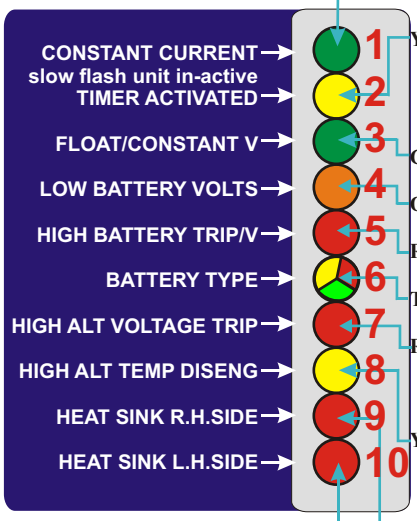
Screen 4a:
Push button marked Temp 4a+b: There are 2 x screens on this button. Push once for screen a, then again for screen b. Screen a shows the alternator temp and the domestic battery temp, if the temperature sensors are not fitted it will default to 20 deg c

```
Alt Temp + 20C
Bat Temp + 20C
```

Screen 4b:
Push button marked Temp 4a+b: There are two screens on this button. Push once for screen 'a', then again for screen 'b'. Screen 'b' shows the box heat sink temperatures. LHS stands for left hand side. Guess what RHS stands for :-)
Do not expect these to be the same temperature.

```
Case LHS + 17C
Case RHS + 23C
```

L.E.D. information and alarms



Green High Charge Rate On: (top L.E.D. 1) This should be on from start-up (**slow flash** shows unit is on, but on rest mode, for the first 2.5 mins on start-up and every 20 minutes or so thereafter, see graph) and shows that the alternator should be working at its maximum. It should remain on until the green float comes on and this shows that the high charge rate is complete.

Yellow Timer Activated: This comes on when the voltage reaches about 13.9 - 14 volts (x 2 for 24 v), and depending on how long it took to come on, will dictate how long the timing cycle will remain on. The software will calculate the timing for the high charge rate. This will vary from 1 - 6 hours and the time will be displayed on the remote panel and a count down . This light will remain on until the high charge rate is over, and will go out at the same time as the high charge rate between 1-6 hrs after activation.

Green Float Mode: This indicates that all the high charge cycles are now over and should remain on after all the high charge lights are out. The system is now running at a standard charge rate only (about 14 volts) regulated on the battery.

Orange Low Voltage Warning: This is simply says that there is a low voltage at the main battery bank and has no active function. For information only; usually indicates a defective alternator.

Red Dual Information L.E.D: This L.E.D. Has two functions and as such has two display modes. flashing = high temp trip and l.e.d. on permanent = high battery voltage trip

Tri Coloured L.E.D: This simply displays the battery type that the processor has been set to. This is a tri-coloured l.e.d. Yellow = open lead acid, Green = gel /sealed lead acid . Red = A.G.M..

Red High Alternator voltage trip: This will warn you and switch off the boost section. This means that your alternator's own regulator has failed and that the alternator will now boil and destroy your batteries. There is simply nothing we can do about this, except warn you. Please take this warning very seriously and stop your engine as soon as possible. Remove the alternator input cable, then continue your journey and have the alternator repaired.

Yellow: System disengaged, this refers to the boost section being deactivated for the following reasons: The alternator temperature sensor has exceeded 90 deg c and has automatically disengaged the unit to allow the alternator to cool down, there is a high temp on the heat sink, or there is a high temperature on the battery temp sensor. It will reset once the safety parameter that caused the problem has been reduced.

Red : This gives a simple warning that the product is overheating. In this case the boost section will switch off and should reduce the problem. However, we cannot prevent the unit continuing to overheat if it has been placed in a bad place such as a sealed box with no ventilation. If this high temperature is not addressed by increasing the cooling effect , ie by moving the unit to a cooler place, then it could result in the failure of the unit.

Red: same as above:

Unit expectations

What do I expect to see from this unit and why?

The below test was set up and monitored and is as close as possible as to what happens on the average split charger system, the engine battery is a 100 amp hr standard lead acid, and the domestic battery is 3 x 100 amp hr standard lead acid. The engine battery was discharger to 11 volts (about 10 engine starts) and the domestic bank to about 11 volts (will no longer run an inverter and is about 60% empty . The alternator used is a Bosch 90 amp with a standard 13.9 volt (variable) regulator. the unit battery type is programmed to open lead acid.

There are 2 x graphs , one is the current into the batteries, and the other is various voltages on the system

System voltage graph:

The key points to pick up on here are:

The yellow trace (alternator voltage into the unit) clearly shows that the system is doing its job. It is designed to pull this voltage down a little to enable the standard alternator regulator to produce its full current. You can clearly see that on position 4 on the voltage curve the voltage is pulled down to position . 5 e result in current change is from position - 8 wh 9 is about 70 amps improvement and a good increase in current.

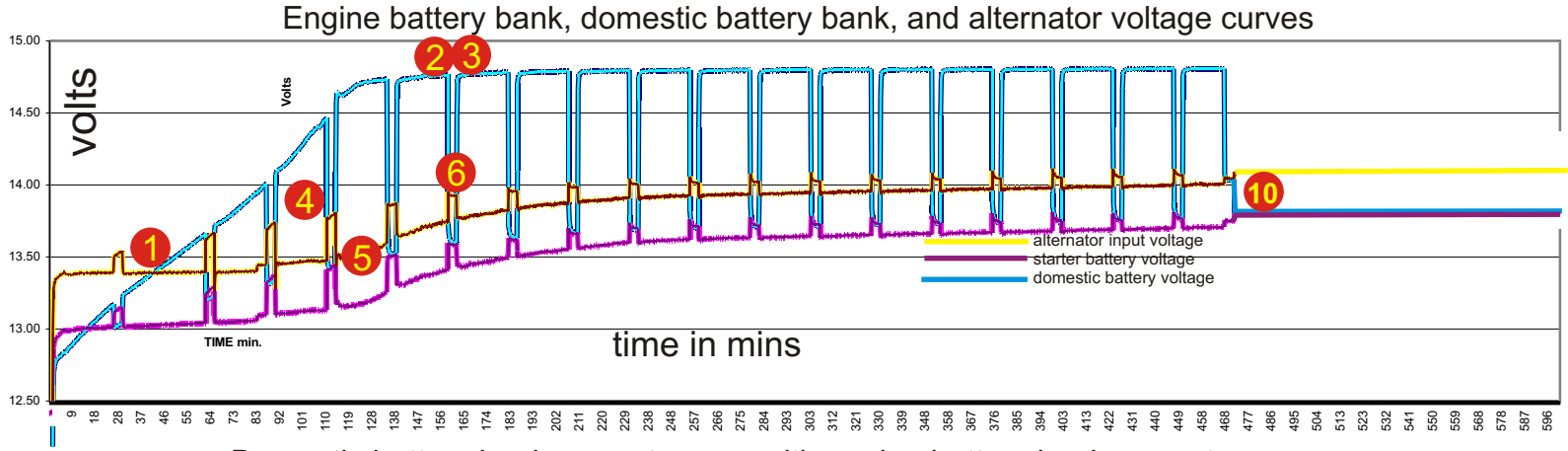
Position 1 : The interesting point here is that this is the magic point, the point where the domestic battery voltage exceeds the alternator input voltage. This is what the process is all about.

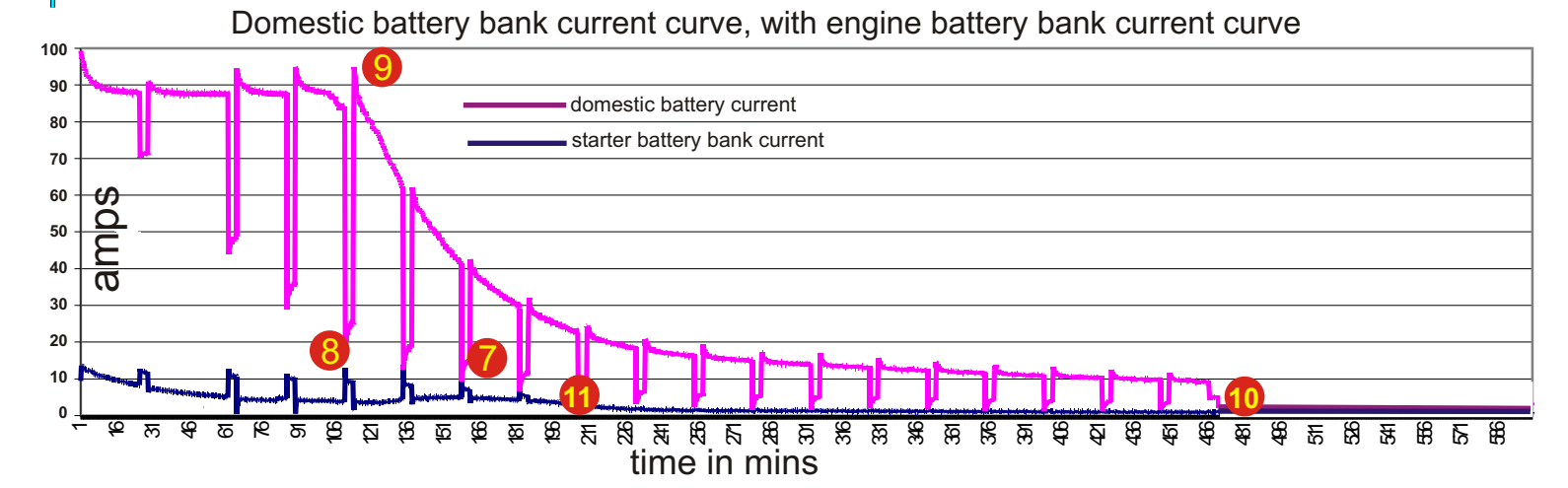
The steps on the graphs show the unit boosting every 15 minutes, then resting for 2.5 minutes. An example of this is the time period between 2 and 3 .What you can see here is that by switching off the amplifier (to help the engine battery charger more), the engine battery voltage curve increases during that step shown at point 6 which results in extra current going into the engine battery at position 7 . The current reflection of this process is reflected in the other graph marked 'the current graph'.

The current graph shows the current flow into the engine start battery and the domestic system. The effect of the amplifier can be clearly seen when the unit switches off for its 2.5 minutes rest cycle. The current drops from position = 95 amps to position = about 30 amps, a 300% difference. At the same time you can see extra going into the starter battery which clearly charges through the whole exercise.

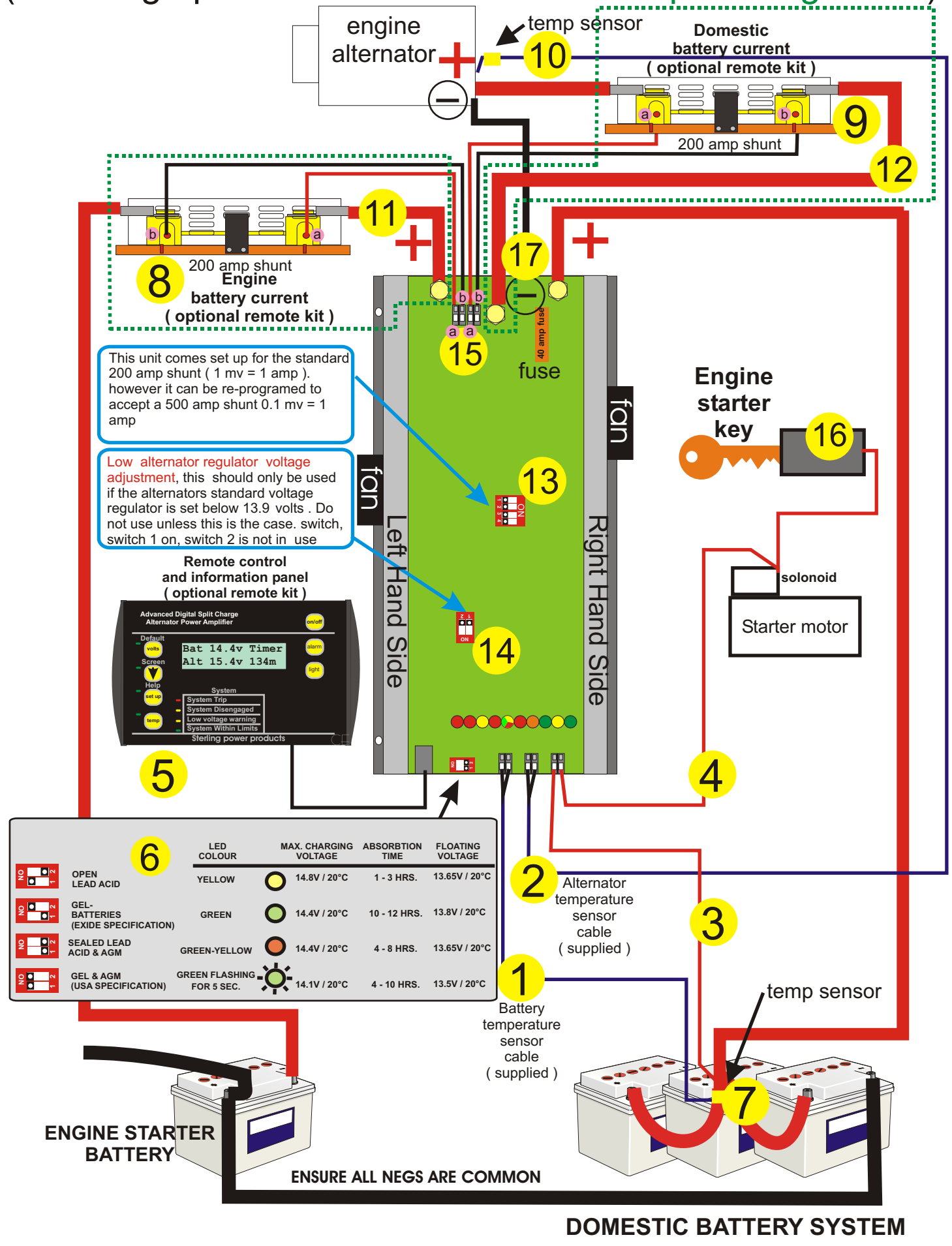
On completion the unit switches off, and the process continues as a conventional split charger system 10 , if however the domestic battery falls below 12 volts, the system will auto restart and continue the process again.

11 Shows that the engine battery is full and taking no more current.

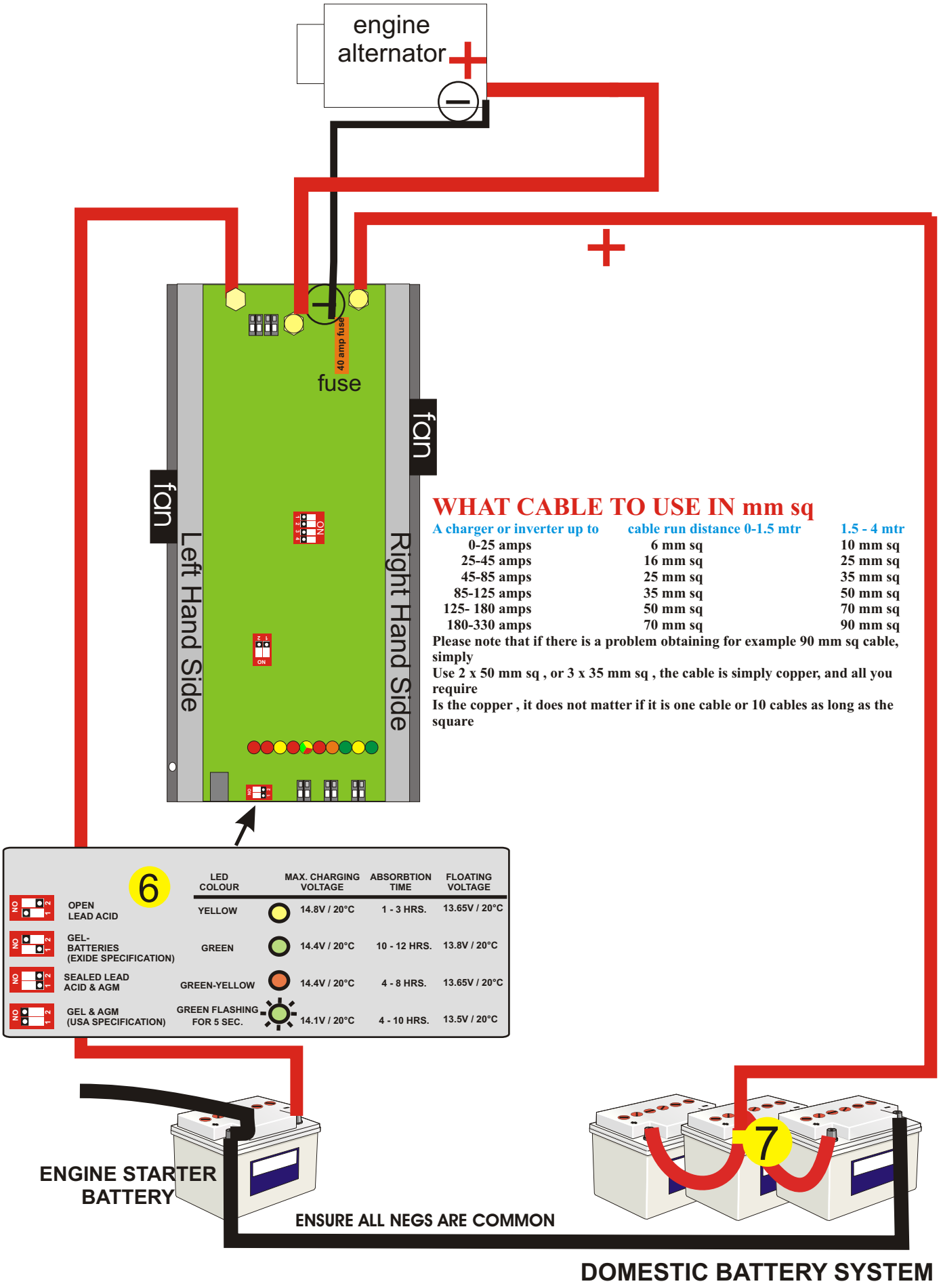




Full System wiring
(including optional remote kit if used Kit parts in green)



Basic wiring System wiring



WHAT CABLE TO USE IN mm sq

A charger or inverter up to	cable run distance 0-1.5 mtr	1.5 - 4 mtr
0-25 amps	6 mm sq	10 mm sq
25-45 amps	16 mm sq	25 mm sq
45-85 amps	25 mm sq	35 mm sq
85-125 amps	35 mm sq	50 mm sq
125- 180 amps	50 mm sq	70 mm sq
180-330 amps	70 mm sq	90 mm sq

Please note that if there is a problem obtaining for example 90 mm sq cable, simply
Use 2 x 50 mm sq , or 3 x 35 mm sq , the cable is simply copper, and all you require
Is the copper , it does not matter if it is one cable or 10 cables as long as the square