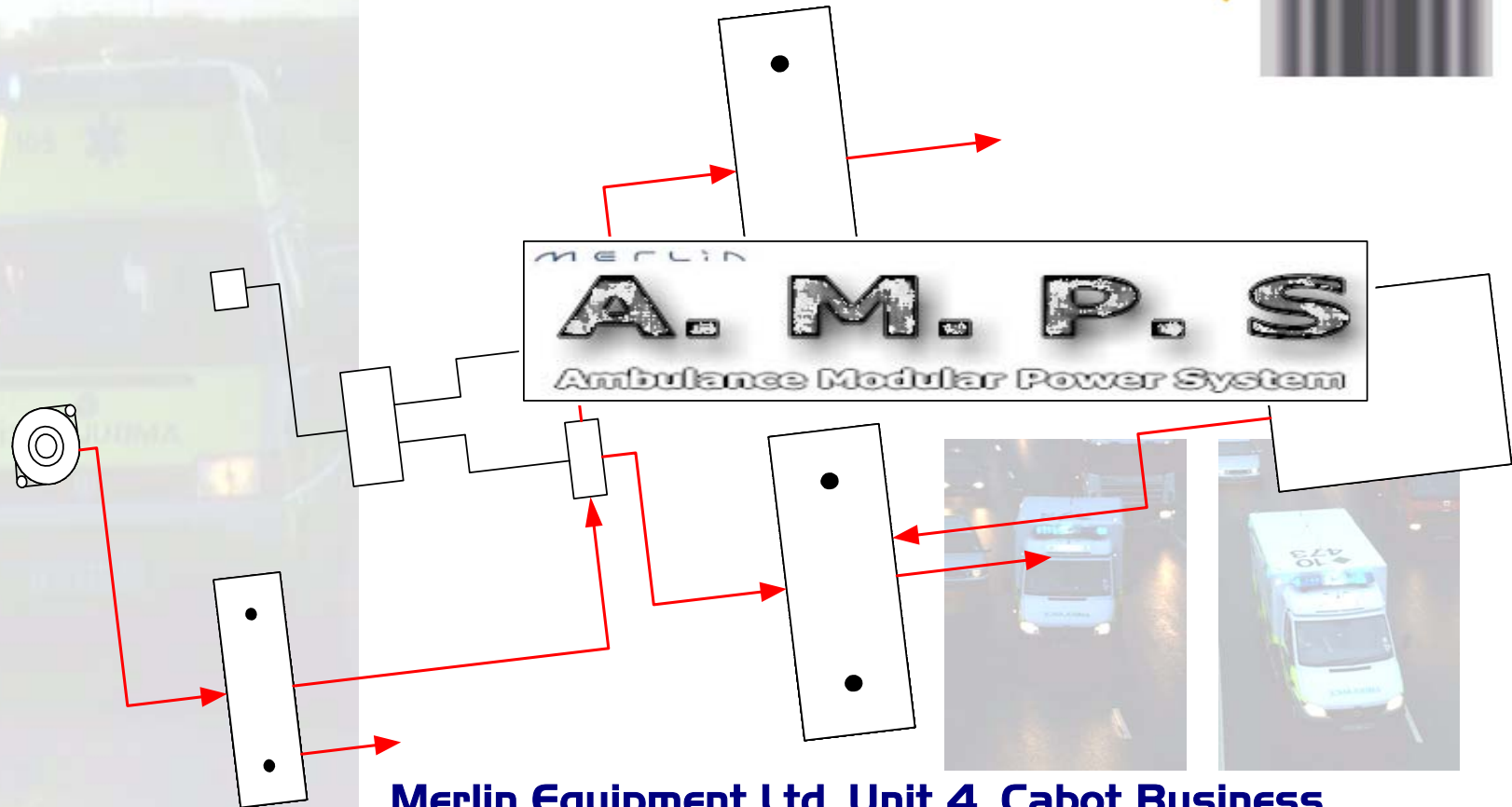
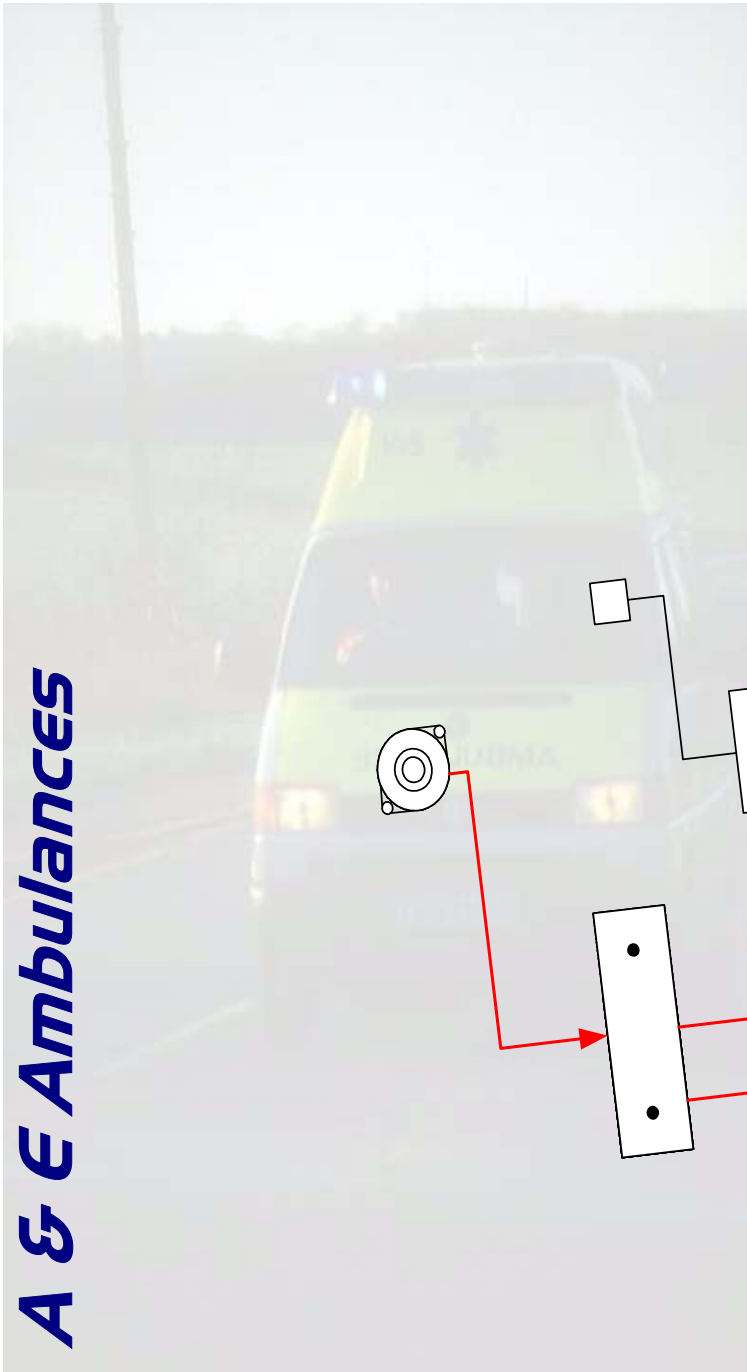


A & E Ambulances



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Ambulance Modular Power System

Why The Need For A.M.P.S ?

It is in no doubt that the lack of available battery power on board today's front line ambulances is a growing problem. Fleet Managers have been working with ambulance builders to customise van manufacturers standard electrical systems to help the converted ambulance meet its operational criteria. The extent to which the standard van electrics are changed in each case is often dependent on the amount of electrically operated equipment on board, where the ambulance is going to operate and the budget available.

Usually the first addition to the vehicle is a "load manager" system that switches individual electrical loads on and off depending on where the ambulance is in its duty cycle. The idea of this is to reduce the electrical load on the ambulance to the bare minimum for each call out. This is a good idea, but unfortunately it will come to a point where no matter what and when you switch things off and on, the electrical demand is still simply too much for the vehicle. In fact, what you are doing is working backwards, cutting the availability of essential equipment simply because of the lack of electrical power.

Merlin believes the simple solution to the problem is to focus on producing enough DC power in the first place. If you have done all you can to generate enough power, then you will have to worry far less about critical situations arising from ambulances having flat batteries at scene, or the inconvenience of additional recovery and maintenance costs.

What Is A.M.P.S ?

AMPS is a modular approach to designing a primary electrical system. It allows you to build from a basic primary electrical specification all the way through to a complete, comprehensive solution that would work on any ambulance and virtually guarantee as much electrical power as you could need.

We have developed several standard systems that incorporate some of the finest primary DC distribution products available in the World today. These products have been chosen because they are simply the best at what they do. Each system is designed for reliability, ease of maintenance and installation. We also take into account that van manufacturers do not appreciate complicated "add-ons" that may compromise their existing design criteria and warranty.

With AMPS, you can choose how far you want to go. We can get you there.



A.M.P.System 1

Priority Split Charge System

Our *Smartbank* split charge system allows you to charge up to two auxiliary 12V battery banks from the existing vehicle alternator while always prioritising power for the starter battery.

We can program the *Smartbank* specifically for your application to ensure that your auxiliary batteries receive as much charge as the alternator can deliver while isolating the starter battery from any potentially serious discharge. We do this by assessing the electrical loads on-board and adjusting our control voltages to efficiently balance the charging system.

The *Smartbank* system introduces no voltage losses to the system, which could make your alternator charge much less efficiently.

The *Smartbank* system includes a dash-mounted switch that allows the driver to momentarily combine all of the batteries on board. This means that you will always be able to restart the ambulance, even in the event of a catastrophic starter battery failure.



The *Smartbank* control processor is extremely compact; allowing it to be installed almost anywhere. The electrical relays used to distribute the power can handle continuous currents of well over 200 amps. This means that they will not suffer from “burn out” like other smaller automotive relays that can mean one or more of the batteries being completely flattened.

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For *A.M.P.System 1* we can either supply one or two 210Ah auxiliary batteries. This is purely dependent on the electrical loads on the vehicle and how you want the system to operate. The batteries we supply utilise the most advanced technology available for ambulance use. *Lifeline AGM* batteries provide advantages in safety, efficiency, and durability over all other commonly used batteries.

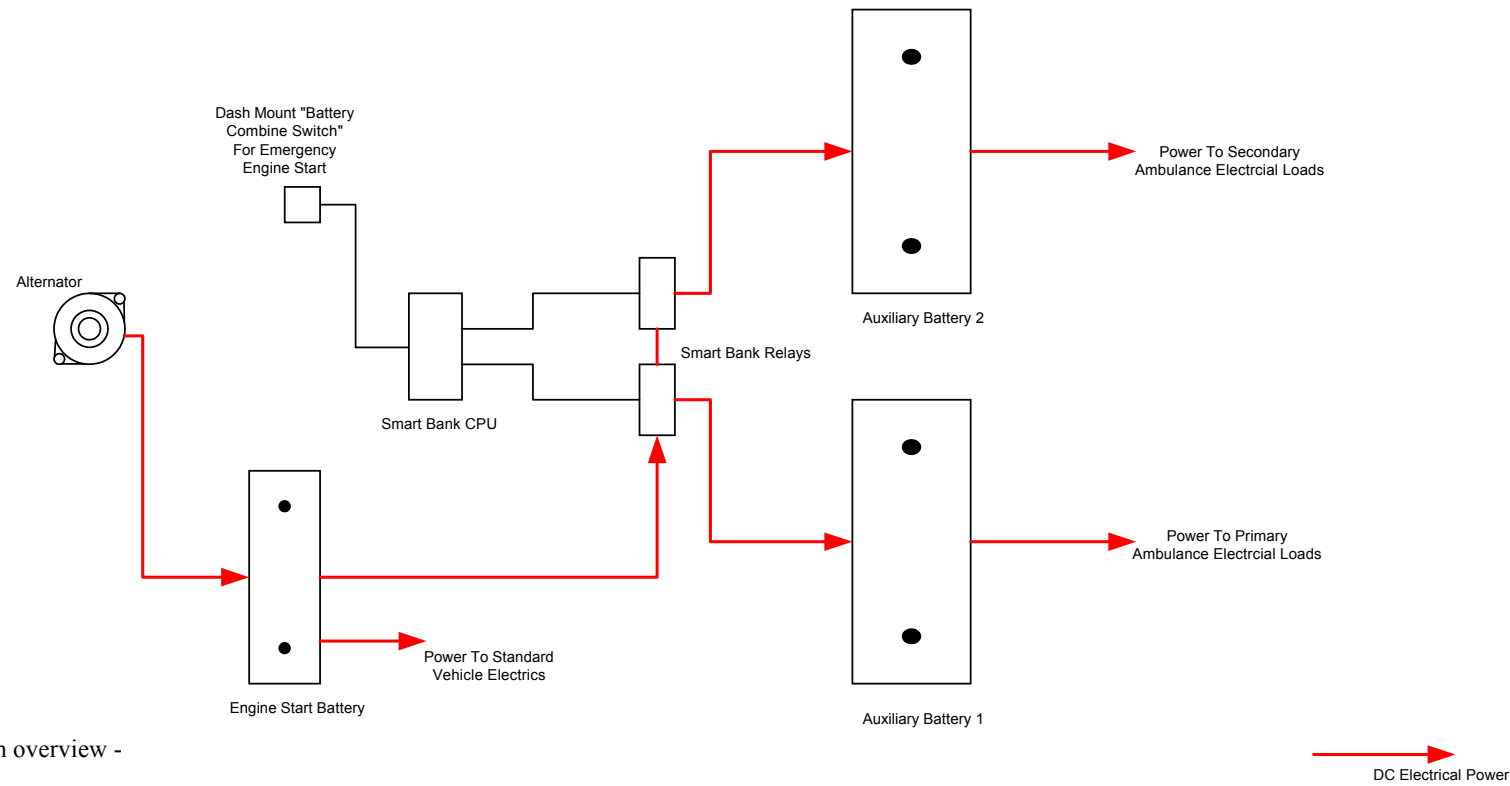
Inside a *Lifeline* battery all of the acid is absorbed into a unique glass mat. The *AGM* material has an extremely low internal resistance, which allows the battery to be charged faster than most others with no limitation on charging current. This means that the batteries are capable of absorbing much more charge than a conventional lead acid or gel battery and will therefore perform much better even when the ambulance is only doing short journeys. Conversely, they can also supply sustained high currents for operating passenger lifts, DC to AC power inverters and other heavy electrical loads.



Lifeline AGM batteries are unspillable and can be mounted in any orientation. They recombine 99% of the gases produced during charging and are fully sealed and maintenance free. This means they can be mounted in human compartments safely as with gel batteries. Unlike gel batteries, the *AGM* material does not suffer from the damaging hairline cracks that develop in a viscous gel which can lead to poor charge retention and reduced conductivity.

A.M.P.S System 1 (Priority Split Charge System)

Note: Three battery system shown - Two battery system also available



Note: This is a system overview - not a wiring diagram

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A.M.P.System 2

Priority Split Charge System With On-Board Mains Charger

Our *A.M.P.System 2* includes the *Smartbank* priority charge system and *Lifeline AGM* batteries from *A.M.P.System 1*.

In addition to this we also add an on-board mains powered battery charger.

Our *Power-tec 50A* battery charger is a super compact charger developed to be fitted in applications where there is almost no available space. The footprint of our *Power-tec 50A* charger is approximately the size of half a sheet of A4 paper ! When mounted to a bulkhead, the charger stands only 7cm high.

The *Power-tec 50A* charger is a fully automatic multi stage charger. Working in conjunction with the *Smartbank* system, the unit will deliver 50A continuously if the batteries are discharged, replacing the power used extremely quickly. This is obviously beneficial if the ambulance can only be in the station for a short period. Once the batteries reach 80% charged, the *Power-tec 50A* will regulate its output to replace the final 20% of capacity quickly but safely and then simply "float" the batteries at 100%.



Any spare capacity available during or after charging can be used to run DC loads left operating while the ambulance is stationary. If the crew leave a heater operating that draws 30A then the *Power-tec 50A* will compensate by putting exactly 30A into the batteries. This ensures the batteries are always left in the best possible state.

The *Power-tec 50A* unit is programmed by Merlin specifically to charge the batteries used in the *A.M.P.System*. If the specification of the batteries used on the ambulance should change for any reason, the unit can be easily adjusted to different types. (It has sixteen memorised charge programs).

The *Power-tec 50A* charger has a universal power supply and will therefore operate from any 230 volt or 110 volt AC ambulance station supply. The unit is among the most efficient chargers available today and its power factor corrected design means that it will draw a maximum of 600W AC. This obviously means that several ambulances can be connected to one distribution point / transformer in the station without continually blowing consumer fuses or breakers !

Like all of the equipment Merlin specifies, it is fully serviceable in the UK.

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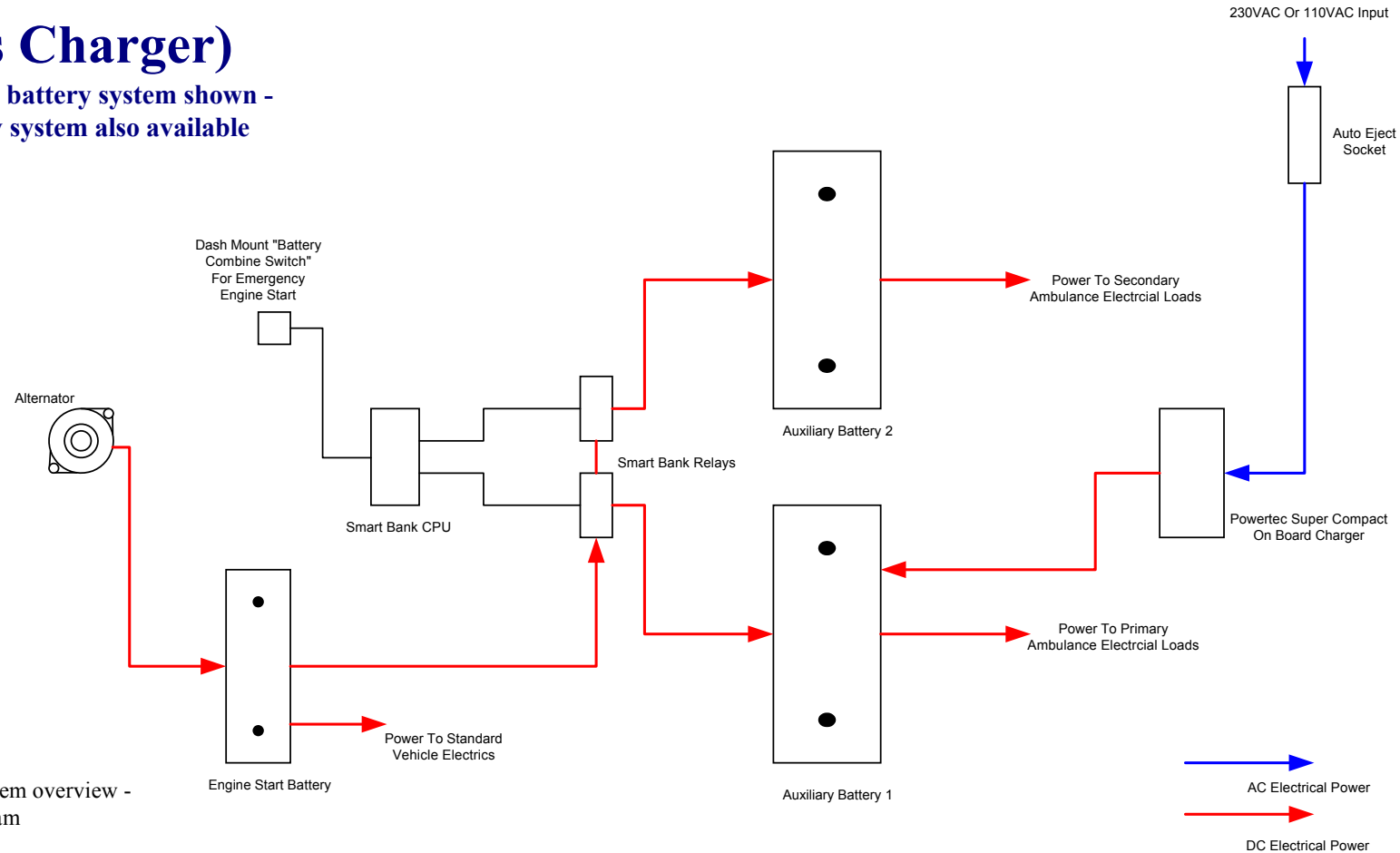
The *Super Auto Eject 15* is an ideal way of connecting the *Power-tec 50A* charger on the ambulance to a grid supply. The *Super Auto Eject 15* is a completely sealed, automatic power line disconnect.



The unit will automatically eject the mains supply plug from the socket on the side of the ambulance when the crew attempts to start the ambulance engine. This eliminates the possibility of damage to the vehicle and the station. The sealed design prevents contamination from road dirt.

A.M.P.S System 2 (Priority Split Charge System With On Board Mains Charger)

Note: Three battery system shown -
Two battery system also available



Note: This is a system overview -
not a wiring diagram

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Project: AMPS 2		Checked J.E.H.	Drawing JH010702.2



A.M.P.System 3

Priority Split Charge System With On-Board Mains Charger & Alternator Controller

Our *A.M.P.System 3* includes all of the equipment featured in the first two systems as well as our *Maxcharge* alternator charge controller.

The *Maxcharge* system can be installed on any modern alternator, either as an addition to or as a direct replacement for the existing alternator regulator.

As with other systems on the market, the *Maxcharge* works on the principle of sensing the voltage and temperature conditions of the most heavily discharged battery and controlling the alternator to compensate and adjust its charge program to suit. The clamped voltage output regulation on most alternators was only ever designed to simply replace the power consumed by headlights and engine cranking. Specialist alternator control *is* needed to cope with massively increased electrical loading, multiple batteries, voltage losses on extended cabling to auxiliary batteries and specialist battery types.

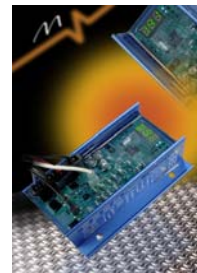
Even if you have upgraded to a high output alternator on the base chassis (always recommended), if the standard alternator regulator is used, it is likely that you will only ever realise around 55% of the available alternator capacity. Without specialist charge regulation, trying to get the power back in quickly is simply like trying to force a square peg into a round hole !

The *Maxcharge* system effectively turns your alternator into a fully automatic, multi stage charger very similar in operation to the *Power-tec* unit. This ensures that even during a short journey, the alternator replaces as much battery capacity as is possible.

In certain cases, it has been possible to improve charging efficiency by up to 40% by using the *Maxcharge* system. This obviously

makes a huge difference and could easily tip the balance if the ambulance is marginally under-powered.

In the past vehicle manufacturers have objected to alternator controllers. Their main concern was that with discharged batteries, the alternator could attempt to provide full output when the vehicle had just been started and was cold. This could lead to “belt screaming” and excessive wear on both belts and moving alternator components.



The *Maxcharge* does not have this problem as it has a programmable start delay that allows the engine and alternator to warm up before it begins charging. In addition to this it then uses a voltage ramp to gradually increase the load on the belt to avoid over stressing.

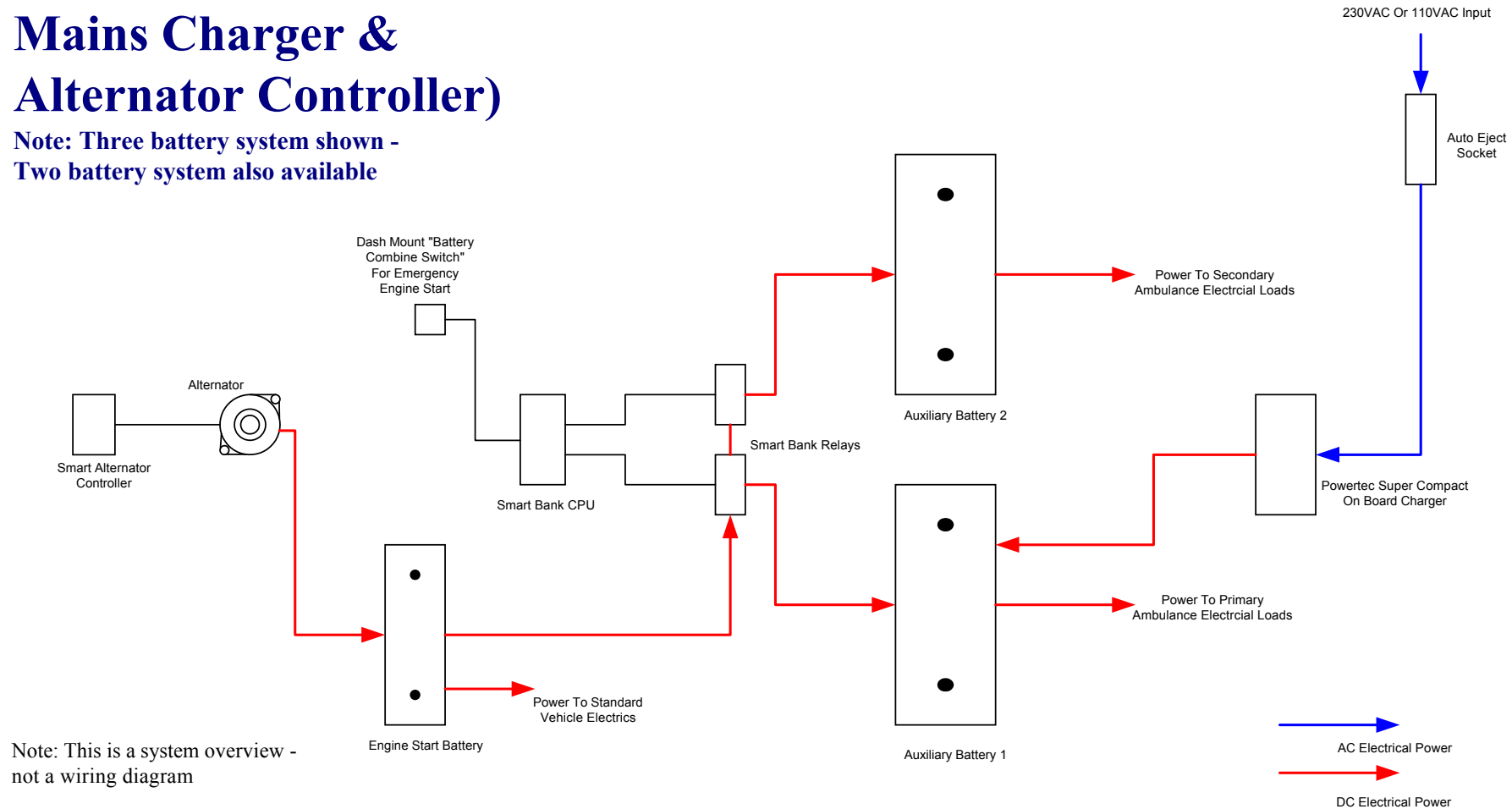
A digital display on the *Maxcharge* processor displays the status of the unit as well as fault codes for permanent or intermittent difficulties. This method is very useful for identifying wiring problems quickly without taking multiple voltage references throughout the system.

The *Maxcharge* can be programmed by Merlin to charge any type of batteries and maximum operating temperatures can be set for both batteries and the alternator. There is even a program to avoid blowing halogen bulbs, which can happen with other systems as the alternator output voltage is controlled up and down.

A.M.P.S System 3 (Priority Split Charge System With On Board Mains Charger & Alternator Controller)



Note: Three battery system shown -
Two battery system also available



Note: This is a system overview -
not a wiring diagram

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Project: AMPS 3		Checked J.E.H.	Drawing JHO10702.3



A.M.P.S Options

Advanced System Upgrades

PUREsine & PROsine Inverters

Our *PUREsine* and *PROsine* inverters are designed to convert the DC power from one of the *Lifeline* auxiliary batteries to 230V AC mains. The 230V AC mains power can then be used to operate syringe pumps, re-chargers for Ni-Cad batteries found in medical equipment and even incubators.



The 230V AC mains produced is not the synthesised modified square wave supply created by inferior products but an absolute pure sine wave supply. This means that it is identical to grid AC and therefore can operate any appropriately rated mains appliance without any compatibility problems.



Merlin will advise on the correct inverter to use for your application. This is important as sizing an inverter can depend on a variety of factors including continuous vs. peak power requirements and temperature variations. Our *PUREsine* units vary from 150W to 600W continuous output and our *PROsine* units from 1000W to 1800W.

Safety features include, low input voltage shutdown (to protect the batteries), short

circuit protection, over temperature and over load. Merlin will also ensure that the correct DC fusing and mains RCD is incorporated into the installation package. The two types of inverter we use have been selected for AMPS because of their specification and proven reliability.

Expert 501 Battery Monitors

Merlin's *Expert 501* battery monitors will provide all the information that both the driver of the ambulance and the fleet maintenance engineer could wish to know.

At a touch of a button the unit will display battery voltage, total discharge or charge current, percentage of capacity remaining and time remaining until batteries are flat. That means that the driver always knows how long he has left until the batteries reach a critically low level.

Even with a carefully selected AMPS system, this still offers peace of mind if sat at scene for some time and an assurance that everything is working as it should.



For the fleet engineer, the unit provides more detailed data such as average depth of battery discharge per cycle and average charge time. This allows the engineer to monitor the battery systems performance over a period of time and avoid potential problems by spotting them in advance. It can for example, be used to spot an unlikely but unavoidable cell failure in a battery or a fault with the ambulances alternator. As with modern engine management systems,

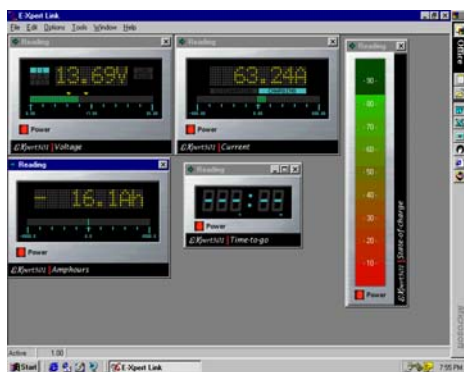


A.M.P.S Options Continued...

Advanced System Upgrades

Expert 501 Continued...

the *Expert* also has the facility to be hooked up to a laptop PC and comes with its own simple Windows based software. This means that the engineer can create a “vehicle file” where he can plot graphs showing how the electrical system is performing between the ambulances regular service intervals.



The Expert’s PC link kit also allows advanced programming and easy “batch” set up for where you may have several Experts on different vehicles to program at once.

Power Guard

The Merlin *Power Guard* is an emergency low voltage, isolation system for the ambulance starter battery.

The *Power Guard* processor constantly monitors the voltage of the starter battery to ensure that it remains at a safe level. If the battery voltage drops below its pre-programmed lower voltage limit, it begins a four-minute timer. If during the four-minute period the voltage recovers, then *Power Guard* returns to stand by mode. If the voltage does not recover and remains below the lower limit, the *Power Guard* will disconnect the starter battery from the electrical system preventing any further drain. The idea of the system is to

preserve enough capacity to be able to restart the ambulance again.

The *Power Guard* reset switch (dash mounted), incorporates an LED which indicates “disconnect imminent” (flashing) and “disconnected” (Permanent).

The only thing that will reconnect the battery to the electrical system is the reset switch. This is pressed purely for the purpose of being able to start the vehicle engine.

The *Power Guard* cannot isolate while the ambulance engine is running, (for obvious reasons).



Although we recommend running auxiliary loads from the auxiliary batteries, it is possible that there will be certain electrical loads that require a permanent 12 volt feed at all times (hazards etc). For this, the *Power Guard* has a current limited bypass facility.

The *Power Guard* itself draws far less current from the starter battery than other similar systems on the market. It is obviously important that the processor in itself is not a detrimental drain on the battery it is connected to. We have achieved this by using ultra low power CMOS semiconductors and ensuring that at all times other than the timer period, 90% of the circuitry is asleep !

The *Power Guard* is not designed to be a “load manager”, but does act as an important safety net.