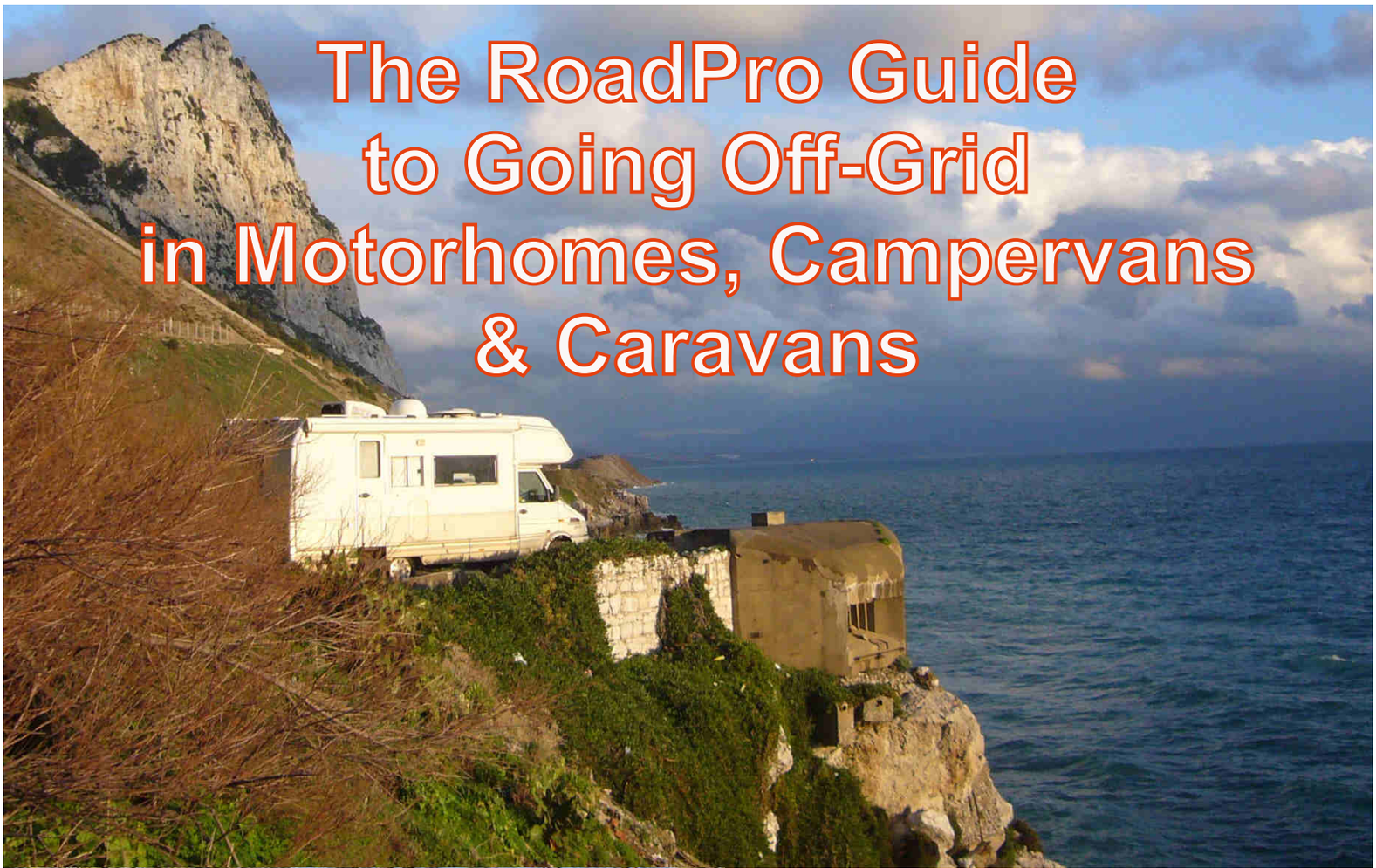
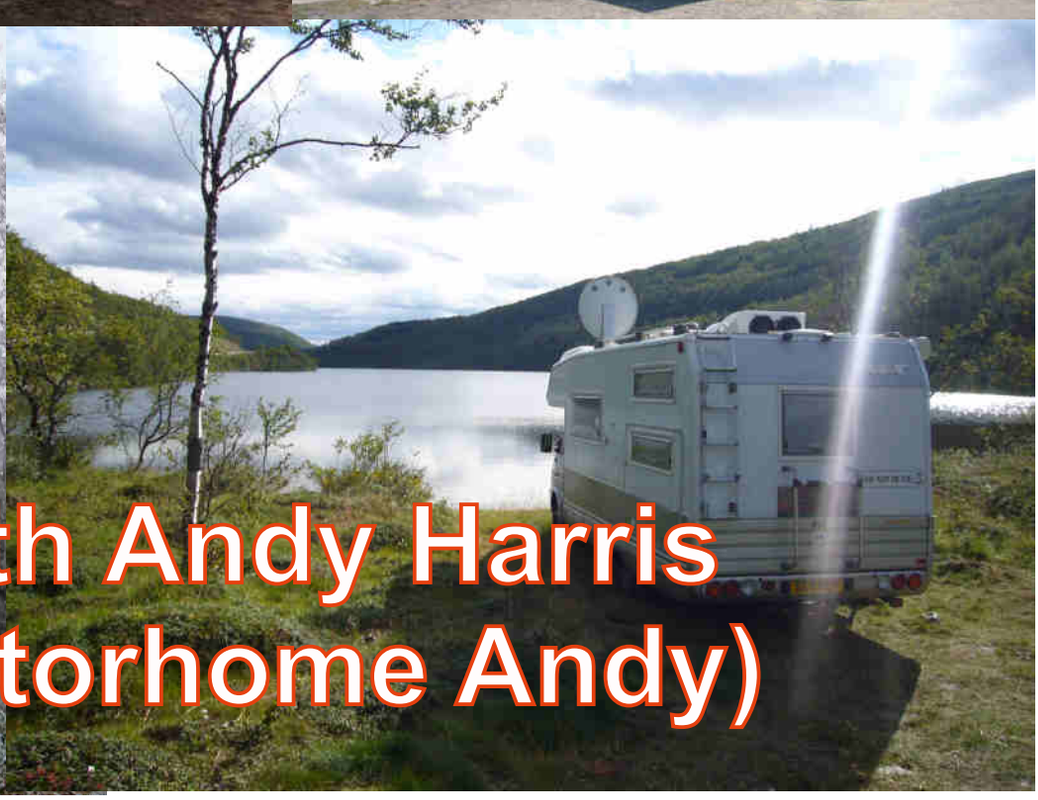
# The RoadPro Guide to Going Off-Grid in Motorhomes, Campervans & Caravans





## With Andy Harris (Motorhome Andy)

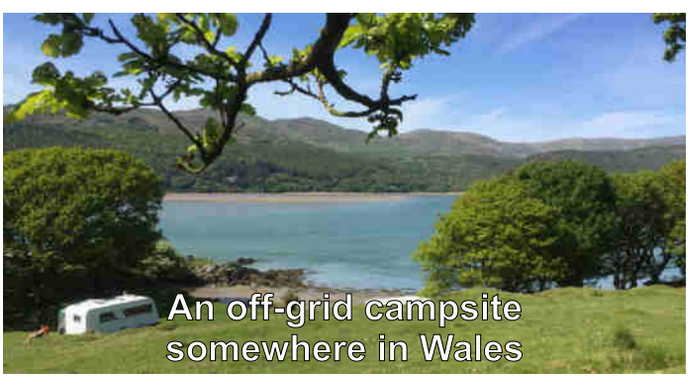
# Why Go Off-grid?

If you're lucky enough to have a motorhome, a campervan or a caravan, you can clamber aboard and, in theory, go absolutely anywhere there are roads to drive down. If you've got the right sort of vehicle, you don't even need a road. That's the theory. In reality, the majority of people seem happy to head straight for a campsite with all mod-cons and line up in neat rows with hundreds of other like-minded campers. If that's what you like, great! Enjoy.

## Looking for the simple life?

Many people enjoy the security that campsites offer, the facilities and the way you can get your awning out and just relax for a few days or weeks. But maybe the regimentation, the rules and the holiday camp atmosphere don't appeal. To cater for people like this - you, maybe - there are thousands of campsites all across the UK that offer space to park up, peace and quiet and...that's about it. Some have basic facilities such as a tap and waste-tank emptying. Some have mains hook-up - EHU - but many don't and these include some of the quietest, most attractive sites in the UK.

Another appealing feature of these "nothing fancy" campsites is the price: from as little as £2.50 a night. The campsites with the lowest prices tend to be the ones with the fewest facilities. This used to mean that, if you depend on mains electricity to run your domestic appliances or you want to be certain that the TV doesn't drain the leisure battery just as Coronation Street gets to an exciting bit, you would be missing out on some very nice campsites.



An off-grid campsite somewhere in Wales

However, thanks to the technology that's now available to anyone in a motorhome, campervan or caravan - *shall we just say LV (Leisure Vehicle)? It makes sense and it'll save so much time* - it's quite possible to stay out in your LV with no mains hook-up for days at a time and still enjoy using your hair-dryer, toaster, microwave oven, coffee maker, etc. The best thing about being able to do this is the freedom it gives you. Even if you're quite happy with few or no mains-power appliances, the right equipment helps. Imagine not even having to think about EHU (mains hook-up) when you plan your trips: with modern technology, you can be self-sufficient and free to go anywhere your LV will take you.

## Why be a "Campsite Captive"?

But if you don't fancy being a "Campsite Captive", even if the campsite is miles away from anywhere, with no shower block and just half-a-dozen LVs scattered around, there's always "wild camping". This means different things to different people. It can involve belonging to an organisation like BritStops and staying in pub car parks or, if you're on the continent, taking advantage of the aires that can be found in just about every European country - except the UK!

For some people though, wild camping means having no plans at all about where to spend the night and taking life as it comes. That can mean parking in the street, in car parks or any place where there's no one around to object or there is someone to ask for permission. Wherever you choose to lay your head, the rules are simple: leave no trace behind and take away nothing but memories. This kind of wild camping can result in experiences that will stay with you forever.

All set for a quiet night on top of a gun emplacement on Gibraltar

**What do I know about off-grid camping?**

During the past 20 years, I've travelled getting on for 250,000 miles in leisure vehicles of one sort or another: all over Europe, in Africa, America and Australia. During that time, I'm pretty sure that I've spent less than 30 nights on campsites of any kind and of those campsites, I remember using the EHU once.

In Albania, I saw a large service station forecourt and handed over a 5 Euro note in appreciation when I was given the OK to park in a quiet corner for the night. I didn't expect one of the attendants to grab a chair and a Kalashnikov AK47 and spend the night on guard next to the motorhome.

Then there was the time when we camped in a car park next to the Bosphorous in Istanbul and shared a barbecue with the Chief of Police who had parked his car next to us. And we once spent a memorable night on top of a disused gun emplacement in Gibraltar: the view was sensational. In Norway, we were the northernmost motorhomers in Europe: it was bitterly cold but we were comfortable enough, watching reindeer wander past while we were parked in a rest area. This kind of camping isn't for everyone but I reckon it's a lot more fun than joining a queue to empty your toilet cassette first thing in the morning.

I've been told that there are some people who never actually use the shower, toilet or kitchen in their leisure vehicles. For all I know, they don't use the beds either. If you're one of these people, a full-service campsite is just what you need, possibly with a nice hotel next door. If, on the other hand, you can hear the great outdoors beckoning and you're feeling just a little adventurous, read on.

**Andy Harris, February 2022. @MotorhomeAndy**
**Enthusiastic motorhomer, off-gridder and owner/founder of RoadPro.**

If you're planning to travel abroad, going off-grid is perhaps even easier and often more attractive as well. This is because of the availability of aires and other parking places and also the conditions found in some continental campsites. But off-grid camping is not for everyone and I've devised a simple test to help you decide if you'll enjoy going off-grid or whether you'll be better off sticking to full-service campsites.

Look at the two photographs below. Where would you rather wake up? If you answer Photo 1, carry on reading. If your answer is Photo 2, start making those campsite bookings now!

**Photo 1**

**Photo 2**

# Can *you* go off-grid in *your* vehicle?


You may have thought that going off-grid needs a specially modified vehicle with 4-wheel drive, extra fuel tanks and maybe a winch to drag yourself out of trouble. If you're going to be trekking across Africa, all those things are a good idea and you should think of getting hold of a specially built expedition vehicle like the gigantic one from Australia, seen here parked on our forecourt. But, if you simply want to get away from the crowds and not go too far off-road, you can do it in any kind of LV: caravan, motorhome or campervan.

**All you need is the right equipment.**

***"Going off-grid simply means not having to be hooked up on a campsite in order to enjoy your motorhome, campervan or caravan: it means freedom, independence and, if you're open to them, unforgettable experiences."***





# Just a Few of our Off-grid Customers' Vehicles.

You might think that people with campervans wouldn't need many batteries to satisfy their electrical requirements. So, you may be surprised to hear that the lady owner of the black Wildax on the left has got 600Ah of NDS 3Lion lithium batteries on board. They're charged by a Votronic 70 Amp battery-to-battery charger and a solar panel. Other equipment includes a 2,000W NDS inverter so that she can run all her 240V appliances.
A full-timer, this is her "van for life" and the reason for having 600Ah of lithium batteries? "I just want to be able to do whatever I want, whenever I feel like it, wherever I am." Absolutely, no problem!!

This 4x4 Hymer came to the RoadPro workshop straight from the factory: it didn't even have licence plates. Its owner had plans to travel across Europe, into Asia, to Africa and even further afield. He wanted to do all this in comfort, using his air-conditioning, microwave oven, induction hob, George Foreman grill, 1kW heater, Internet satellite system, etc.
400Ah of 3Lion lithium batteries make this possible and, since we installed the system in June, 2018 the Hymer has been away for most of the time, travelling as far south as Mauritania. During his travels, the owner has only stopped at campsites "when I feel like a bit of R&R."


We installed 2 x 100Ah 3Lion batteries in Brian Williams' Dethleffs motorhome in August 2017. Since then, Brian has spent more than 700 days in his motorhome without once hooking up to the mains. The motorhome spends much of the time in southern Europe with plenty of sun for the solar panels to work efficiently.
Brian says "We obviously need to be sensible about how much power we use but in practice we never need to think about our lighting, use of the TV, coffee machine, hair dryer or food processor."
That's something we hear a lot: "We just never worry about the batteries any more, it's amazing!"

Merve Gaskin won't mind if I say that he's been raving about the joys of going off-grid for years. A keen caravanner, Merve never goes to full-service campsites, preferring the peace and quiet of smaller CLs (certified location) and CSs (certificated sites). He used to rely on lead-acid batteries but, since we installed a 3Lion lithium system in his caravan, Merve has discovered that he no longer has to keep a close eye on the battery's voltage. "It's like having EHU in a box!"
I said Merve was a keen off-gridder: he's so keen that he helped set up the Caravan & Motorhome Off-Grid Facebook group - **CAMOGG**. He'd love you to join.


## But do you really need lithium batteries to stay off-grid?

Yes, it's absolutely possible to stay off-grid in your LV without lithium batteries. But why would you? OK, there's the price: good lithium batteries are a lot more expensive than good lead-acid batteries. But talk to people who've made the leap - including the people above - and they'll tell you that not only do lithium batteries enable them to stay off-grid as long as they want to, they also save them money: enough, in some cases, to cover the cost of having the batteries installed. They save on campsite fees and also on the cost of replacing batteries every few years. Used sensibly and moderately, a good quality battery could last for up to 20 years or more of regular usage.
So, in the long term, they can actually save you money as well as setting you and your leisure vehicle free.

# It's all About the Equipment.

When you stay on a full-service campsite, you need hardly any equipment in your LV other than what the manufacturer put into it on the production line. In fact, most caravans and motorhomes are designed with campsites in mind. Why would you want to stay anywhere else? Are you crazy?! That's why, if you're lucky enough to pick up a new LV from a dealer, there might be a single, 100 Watt (if you're lucky) solar panel, just the one leisure battery and often, as a special gift, a long orange cable so that you can connect your new motorhome, campervan or caravan to mains electricity.

To serious off-gridders, that orange cable is a symbol of failure, a statement that you won't be going off the beaten track and that you will almost always be tethered to a pole on a campsite. I haven't carried a hook-up cable in my motorhome for more than 20 years and, honestly, I've never needed one and never wished I had one.

Of course, you'll still need to fill up with water every now and again and to empty your toilet cassette or grey tank. You may need to fill up with LPG - although it's now feasible to do away with gas as well. With sensible planning though, you can easily go for several days or even weeks, without having to worry about any of these things. It's electricity that we're looking at here, 12V from the battery and, if you want it, 240V from an inverter.

So, what do you need to do to liberate yourself and your LV from the full-service campsites?

It's a simple question to answer: "Get the right equipment." But what is the right equipment? That's the tricky bit and the answer depends on two things: what sort of LV do you have and what do you want to be able to do in it when you're off-grid?

There's a third point to bear in mind. Deciding on the right equipment is one thing but it's essential that it's installed correctly if it's going to work efficiently and reliably. Get it wrong and you're wasting both your time and your money.

## The Leisure Battery:

The leisure battery is the single most important component in your LV. Think about it: without the leisure battery you'd have no lights, no water, no fridge and definitely no fun. It's absolutely critical and yet, when they're buying a new one, many people still look for the cheapest. If you're planning to go off-grid and you don't get your leisure batteries right, you may as well stop even thinking about it. So, first off, a few words of warning.


There's no such thing as a "leisure battery". When we say leisure battery, we're just referring to the battery that's used in the living area of an LV, as opposed to the starter battery. It's usually not even a special kind of battery, even though people who sell them may tell you it is.
A better way of describing it is "house battery" which is the term usually used in America. But, let's stick with "leisure battery" because that's the phrase that everyone in the UK recognises.

It's easy to get fooled by the way batteries are marketed. Many have fancy labels with images of yachts and motorhomes and are labelled as marine, dual-purpose, heavy-duty, deep-cycle, extreme leisure, maintenance-free, light-weight, factory-charged, etc. These descriptions and labels are almost always misleading and usually downright false. The situation is so bad that, at the time of writing, the Office for Product Safety and Standards, part of the Department of Business, Energy & Industrial Strategy is conducting an on-going investigation into batteries in general and this kind in particular.

When it comes to leisure batteries, cheap is just another way of saying not suitable for off-grid use. If your battery


Installation of an "off-grid" system has to be done properly.

is not up to the job, your best bet is to find a mains hook-up point and plug in.
If you're serious about going off-grid, you'll need a battery - or batteries - that will be capable of powering the appliances you'll be using for however long you need them to run for. For example, if you only want to stay away for weekends and your LV is equipped with LED lights, LPG to run the fridge, heating and to use for cooking and you only watch TV for a couple of hours a night, you could probably manage with a single 100Ah wet lead-acid battery. (Ah stands for Amp hours, the capacity of the battery or the number of Amps that the battery can, in theory, supply for one hour.)

If, on the other hand, you're planning to go on expeditions lasting weeks or months at a time and you want to be able to take - and use - all the comforts of home with you, you need to be thinking about batteries with a capacity of 300- 400Ah or even more.

There are dozens of different "leisure batteries" available and, if you're only ever off mains hook-up for a day or two, just a few times a year, one of the many cheap batteries may work for you. For serious off-gridders though, paying extra for a battery that's actually designed for the task is the most important first step you can take on the road to freedom in your leisure vehicle.

# Lead-acid Batteries.

So, how do you choose the right battery or batteries for your RV? If you've read the **RoadPro Guide to Lead-Acid Batteries**, you'll know that there are several different sorts of lead-acid battery, each with plus and minus points when used as leisure batteries. For off-grid use though, most lead-acid batteries are pretty much useless and so we now only sell AGM batteries.

**AGM (Absorbed Glass Mat) batteries** are a good choice for off-grid use when compared to other lead-acid batteries. They are more resilient when heavily discharged and they're completely maintenance-free. They can also be placed in any position, except upside-down. Another important advantage of good AGM batteries is that their construction makes them less vulnerable to vibration; important if you're going off-road.


At RoadPro, we only supply Green Power batteries from Italian manufacturer NDS.

Their construction and the chemistry used - lead/calcium alloy - ensures excellent performance and high reliability. Motorhome manufacturers including Adria now use Green Power batteries as original equipment.

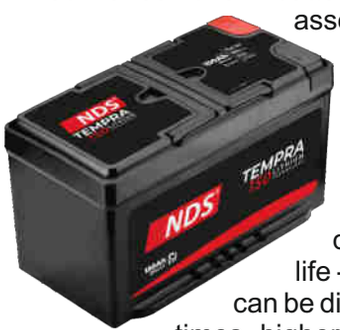
We recommend Green Power AGM batteries to off-grid campers who don't need to run a lot of 240V appliances but want high reliability and good performance even when off-grid for weeks at a time.

**We equipped this stunning VW Crafter with 4 x 110Ah Green Power batteries for total off-grid freedom.**

# Lithium Leisure Batteries - The Game Changer.

When lithium batteries suitable for use in LVs became available, several years ago, not many people even noticed. Now, with prices having fallen and the technology improving all the time, lithium batteries enable anyone with a motorhome, campervan or caravan to free themselves from their orange hook-up leads and make the most of their LV, wherever they happen to be.

What makes lithium batteries so special? The problems associated with lead-acid batteries don't apply to lithium batteries. They can be charged quickly, they can be heavily discharged while still holding a usable voltage, they aren't as easily damaged by rapid or deep discharging and the cycle life - the number of times the battery can be discharged and charged - is many times higher than that of most lead-acid batteries. **For the full story, see the following pages.**




The actual cycle life of a lithium battery depends on the quality of the cells, the BMS (Battery Management System) and the way it's used. A good lithium battery, properly installed and used moderately - without excessive discharging - can last for 3-5,000 cycles or even more. That's more than 20 years for a typical motorhomer.


Lithium batteries can be placed in any position except upside-down, are maintenance-free and completely safe when installed correctly. Crucially, they also have almost twice the energy density of lead-acid batteries, so that a 100Ah lithium battery can provide almost the same amount of usable energy as two 100Ah lead-acid batteries.

As is the case with lead-acid batteries, not all lithium batteries are what they appear to be. The quality of the cells varies and - something you don't need to worry about with lead-acid batteries - the BMS will vary between different makes and models. The BMS controls the way the battery's cells are charged, how they discharge and how they react to unexpected voltage spikes, low temperature and other external influences. A good BMS makes a huge difference to the way a lithium battery performs and also to its life expectancy.

**Warning!** Some inverters, especially high-output models, draw a high current from a battery when first connected. The BMS in some batteries is not able to cope with this and may switch off, sending the battery to sleep. All of the inverters and batteries sold by RoadPro are fully compatible with each other.

# Do You Need One Battery or Several?

If your off-grid plans involve staying away from mains hook-up for just the odd weekend and you only want to use your battery to power lights, the water pump, and a TV, then a single 100Ah battery will do the job.

But, if you're more ambitious and want to stay off-grid for days or weeks at a time, you may need several batteries, especially if you're going to be running an inverter to power your 240V appliances. Connecting batteries in parallel is easy to do but in the case of lithium batteries, different models vary in the number which can be connected in parallel, to give a greater Amp-hour capacity at 12V.

Some cheaper batteries can only be connected in pairs but others, such as **NDS Tempra** & **Poweroad Infinity** models can be joined together in fours or even sixes. Four x 150Ah batteries will provide 600Ah which is roughly equivalent to the capacity of 10 x 110Ah lead acid batteries but weighing 50% less. With this much battery capacity in your motorhome, you may never have to hook-up to mains electricity ever again!

How much battery capacity you need depends on how you want to use your vehicle. See the following pages for advice on how to calculate what you'll need.

# More About Lithium Batteries.


Lithium batteries were invented and developed in the 1970s and 80s and have totally changed the way we use many electrical appliances. It's only recently though, that the advantages of lithium battery technology have begun to be available to motorhomers, caravanners, boaters and anyone who relies on 12V batteries for power.

The difference in performance between a lithium battery and a traditional lead-acid battery is so great that anyone who is serious about staying “off-grid” in their vehicle or boat really has to consider installing one. It can only be a matter of time before lead-acid batteries are consigned to the proverbial dustbin of history.

Let's get one thing clear to start off with: there are several different types of lithium battery and the ones that are used as auxiliary / leisure batteries are very different indeed from those used in electric cars, mobile phones and cordless electric tools. The ones we're talking about here are lithium iron phosphate (LiFePO4) batteries and here are some of their advantages over traditional lead-acid batteries:

* ***Voltage remains constant for much longer during discharge.***
* ***Much higher charging rate and so faster charging – varies according to the charging system used.***
* ***The ability to charge quickly from the vehicle's engine can remove the need for a generator.***
* ***Can be discharged quickly without damaging the cells, making them ideal for use with inverters.***
* ***Can be discharged approximately 95% on average without damaging the battery.***
* ***Thousands of charging cycles compared to just a few hundred from a typical lead-acid battery.***
* ***Very low rate of self-discharge means they can be left unattended for months.***
* ***Zero maintenance required.***
* ***Can be installed in any position, except upside down.***
* ***Approximately 50% lighter than a lead-acid battery with a similar Ah rating.***
* ***Very safe in normal use with no toxic fumes or liquid and no risk of fire in normal use.***
* ***Can be used in almost every situation where a lead-acid battery is being used.***

**No more dead lead leisure batteries.**

There is really only one disadvantage to having a lithium battery in your vehicle or boat and that's the initial cost. This is likely to be significantly more expensive than a lead-acid battery with a similar Ah rating. However, as a lithium battery can remove the need to ever use mains hook-up and can be charged and discharged several thousand times, for most people the purchase cost will be more than recovered during the battery's lifetime. In addition, if you normally use a generator or fuel cell to charge a battery or operate 230V appliances, a LiFePO4 battery means that you probably won't need either of these items. This saves money, inconvenience, excess weight and the necessity for additional fuel.

**No need for a generator.**

## Let's look at the advantages of LiFePO4 batteries in more detail:

***1) Voltage remains constant for much longer during discharge.***

If you've ever been watching TV and the picture has suddenly vanished while the sound stays on, you've experienced one of the problems associated with lead-acid batteries. Even though the battery may only be discharged by only 40-50%, the voltage can drop to a point where certain appliances won't function as they should.

**LiFePO4 batteries maintain usable voltage throughout the discharge cycle, down to as low as 5-10% state of charge.**

This VW Crafter has a 130Ah lithium battery which is used to run all the 12V & 230V appliances, including the heater. Rob & Sue have spent several years travelling in Asia, Europe and Africa, relying on the battery for electrical power.

***2) Much higher charging rate and so faster charging – within the limitations of the charging system used.***

Lead-acid batteries don't respond well to being charged quickly. It can be done but, depending on the battery type, capacity and charging method, it can take many hours to fully charge one. Charging lead-acid batteries quickly can also damage them.

**Because LiFePO4 batteries are able to accept a high rate of charge - over 100 Amps in some cases - they can be charged much more quickly. Even when it's almost fully discharged, a LiFePO4 battery can be safely charged up again much faster than a lead-acid battery. Just running the vehicle's engine for 20 minutes or so can put enough Amps into the battery for hours of use.**

**The charging rate is dependent on the vehicle's charging system and will vary according to how the charging system is performing.**

***3) Can be discharged quickly without damaging the cells, making them ideal for use with inverters.***

Discharging lead-acid batteries quickly can be even worse for them than fast charging. It can cause the plates in the cells to deform and, if done frequently and at a high discharge rate, can dramatically shorten a battery's life.

**LiFePO4 batteries respond well to fast discharging with no adverse effects. This makes them ideal for use with inverters, especially when the appliances to be powered draw a lot of current: coffee machines, microwave ovens, hair dryers and toasters for example: even induction hobs. This ability to reliably power 240V appliances without the need for mains hook-up is one of the primary reasons that people install lithium batteries.**

***4) Can be discharged to as much as 90-95% without damaging the battery.* ***

When a lead-acid battery gets to around 50% state of charge, the voltage will usually have dropped to a point where some appliances may not work as they should. With a lot of batteries – depending on the type, the quality and the condition - this can occur well before the battery is at 50%. So, although a battery is rated at 110Ah, it may only give a useable 60Ah at most which, for many people, may be what they would use during the course of a day, especially in the winter.

**Even when a LiFePO4 battery is discharged to well below 50%, it will continue to provide a high enough voltage to ensure that appliances operate correctly. *When it's been discharged by around 90-95%, a LiFePO4 battery with a good Battery Management System (BMS) will automatically shut down. However, to maximise useful life, it's recommended that lithium batteries are not continually discharged much below 40%.**

***5) Thousands of charging cycles compared to just a few hundred from a typical lead-acid battery.***

Depending on how a lead-acid battery is designed, manufactured and used, it may have a cycle life (the number of times it can be discharged and charged) of several hundred or far fewer. The way a battery is used makes a huge difference to cycle life and the same make and model of battery could work well for six years or more in one vehicle and less than a year in another.

**LiFePO4 batteries have a cycle life in the thousands and, again, the way the battery is used will have an effect. Also, the cells in some LiFePO4 batteries are simply better than others and will have a greater cycle life. For most people, a LiFePO4 battery will last longer than the vehicle they're using it in. For example: using 50 Amp-hours per day, 365 days per year, a 100Ah LiFePO4 battery can be expected to work efficiently for at least 11 years. Use it every day for six months of the year and it should last for well over 20 years. Battery life varies according to use and constant heavy discharging will reduce the useful lifetime of the battery.**

***6) Very low rate of self-discharge means they can be left unattended for months.***

If you leave a lead-acid battery unattended, even for a few weeks, you may well go back to it to find that it's flat. This is not only inconvenient but probably expensive too as a battery that's left in a discharged state will suffer from sulphation, leading to damaged cells and an inability to hold a charge.

**The discharge rate of LiFePO4 batteries will vary according to how the battery is designed but, as a rule, LiFePO4 batteries discharge much more slowly than lead-acid batteries: 2-3% per month on average. This means that a fully charged lithium battery can be left in place for months without losing a significant amount of charge. So you never need to worry that you'll be faced with a flat battery.**

**LiFePO4 batteries work in a completely different way from lead-acid batteries and don't suffer from sulphation. However, it's not recommended to leave a LiFePO4 battery in a discharged state as this could shorten the battery's useful life. Ideally, lithium batteries should be stored with a state of charge between 50% - 80%. The more gently you treat a lithium battery, the longer it will perform efficiently.**

There are 3 x 150Ah NDS 3Lion lithium batteries in this Devon campervan. With this amount of electrical power available, even the air-conditioning unit can be run without the need to be on mains hook-up.

***7) Zero maintenance required.***

A good lead-acid battery being used as a leisure battery should be regularly checked to ensure that electrolyte levels are correct (except for AGM and gel types) and that there's no corrosion.

**LiFePO4 batteries are completely maintenance-free.**

***8) Lithium batteries can be installed in places where a lead-acid battery cannot.***

With the exception of AGM and gel types, lead-acid batteries have to be mounted with the top of the battery uppermost.

**Lithium batteries can be installed in any position except upside down.**

***9) Approximately 50% lighter than a lead-acid battery with a similar Ah rating.***

Lead is heavy and, the better the battery, the more lead there will be in it. This is one of the major disadvantages of lead-acid batteries, no matter what the application.

**LiFePO4 batteries weigh around half what a lead-acid battery with a similar Ah rating would weigh. And, because you can use almost all the energy in a lithium battery, the weight saving can be huge. 2 x 100Ah lithium batteries are roughly the equivalent of 4 x 100Ah lead-acid batteries but the difference in weight can be 60Kg or more.**

***10) Very safe in normal use with no toxic fumes or liquid and no risk of fire in normal use.***

If lead-acid batteries were invented now, they would be forbidden on health & safety grounds. They're full of lead which is poisonous, and acid which burns. And they can explode! Some countries have considered banning them but, as there is no alternative as yet, that hasn't happened.

**LiFePO4 lithium batteries are completely safe when used correctly. They are non-toxic, they don't give off dangerous fumes and, in normal use, they cannot explode or catch fire.**

***11) The ability to charge quickly from the vehicle's engine can remove the need for a generator or fuel cell.***

Generators are often used both to charge a leisure battery and provide 240V. But generators have many disadvantages as anyone who's used one or had to listen to someone else's will know. Fuel cells are excellent for charging lead-acid batteries but they are very expensive, take up space and require the use of special fuel which is expensive, often difficult to obtain, hazardous and heavy.

**A LiFePO4 lithium battery gives the advantages of both generators and fuel cells. It can be charged simply by running the vehicle's engine and charging is many times faster than even the best fuel cell. If you want to run 240V appliances, an inverter can do the job just as efficiently as a generator and without the inconvenience and noise!**

***12) Can be used in almost every situation where a lead-acid battery is being used.***

Lead-acid batteries have been developed to the point where there's a range of models to suit most applications. But, whatever the type of lead-acid battery, it will have the inherent disadvantages described previously.

**There are many different types and models of lithium batteries too but here we are only referring to leisure / auxiliary batteries. Whatever the Ah capacity of the batteries you need, there is probably a lithium model to suit. Batteries can be joined together to create a battery bank that's big enough even to run air-conditioning systems.**

**In a nutshell, here are ten reasons why you should seriously consider installing a LiFePO4 lithium battery in your vehicle or boat…..**

1. You want to be able to spend as much time as possible “off-grid”.
2. You want to run a coffee maker, hair dryer, microwave oven, toaster, induction hob or any other 240V appliance when you're not on mains hook-up.
3. You need to use medical apparatus - such as a PAP or CPAP device - in your vehicle and want to be certain that it will function correctly when needed.
4. You'd rather use electrical energy than rely on LPG in your vehicle or boat.
5. You want to save money by not having to pay for mains hook-up ever again.
6. You don't want to ever have to worry again about the lights, the TV or other 12V appliances going off because the battery “has died”.
7. You want to save weight in your vehicle.
8. You've had enough of lead-acid “leisure” batteries that only last a couple of years or so.
9. You're tired of having to check your batteries and maintain them even when they're not being used.
10. And finally, because lithium batteries last so long, they will actually save you money in the long run.

# Here's how to work out (roughly) what battery capacity you'll need.

To get an idea of the battery capacity that you'll need to be able to go off-grid, you need to know how much energy you'll be using. You may not want to run an air-conditioner and, if you don't have a campervan, you probably don't have a 12V fridge but this chart will give you an idea of what you need to be aware of when going off-grid.

As you can see, a fridge is the heaviest 12V consumer overall but running 240V appliances through an inverter can take the most out of the battery at any one time. Bear in mind too, that an inverter will add 5%-10% to the total Amp/hour demand of a 240V appliance.
The totals show the Amp hours used over the course of a day.

| Appliance | Typical Watt rating | Amp rating *(Amps = Watts/12V)* | Minutes usage per day | Amps per minute *(Amp rating/60)* | Total Amp/hour demand *(minutes usage x Amps per minute)* |
|---|---|---|---|---|---|
| 12V Phone charger | 5 | 0.4 | 60 | 0.01 | 0.4 |
| 12V LED lights x 6 | 6 | 0.5 | 240 | 0.01 | 2.0 |
| 12V 21" TV | 24 | 2.0 | 240 | 0.03 | 8.0 |
| 12V fridge | 48 | 4.0 | 480 | 0.07 | 32.0 |
| 12V WiFi system | 6 | 0.5 | 1440 | 0.01 | 12.0 |
| **Total for 12V appliances** | | | | | **54.4** |
| 240V Laptop power supply | 70 | 5.8 | 60 | 0.10 | 5.8 |
| 240V Microwave oven - small | 1,000 | 83.3 | 12 | 1.39 | 16.7 |
| 240V Coffee maker | 1,500 | 125.0 | 10 | 2.08 | 20.8 |
| 240V Toaster | 1,000 | 83.3 | 5 | 1.39 | 6.9 |
| 240V Hair dryer | 1,800 | 150.0 | 5 | 2.50 | 12.5 |
| 240V Induction hob | 1,800 | 150.0 | 5 | 2.50 | 12.5 |
| 240V charger for bike battery | 90 | 7.5 | 120 | 0.13 | 15.0 |
| 240V Air conditioning | 900 | 75.0 | 60 | 1.25 | 75.0 |
| **Total for 240V appliances** | | | | | **165.3** |

**The most important thing to remember here is: Watts/Volts = Amps.**

So, a 1,500 Watt coffee maker powered from a 12V battery via an inverter will take 125 Amps out of the battery. (1,500W/12V=125A).

Using the coffee maker for 10 minutes will use 20.8 Amp hours of battery capacity.
**Because...** 125 Amps/60 minutes = 2.08 A per minute. 2.08A x 10 minutes = 20.8Ah.

(All consumption figures are approximate.)

## To work out your daily power requirement, use our online energy calculator: **www.rptech.co.uk**

You can see from the chart that the more power-hungry your appliances, the greater the battery capacity that you'll need: with air-conditioning, almost 75Ah per hour But, this doesn't necessarily mean that you need that amount of battery capacity: if you can charge your batteries up reliably and quickly, you can get away with fewer or smaller batteries.

Imagine you need your batteries to provide 100Ah every day. If you're in the south of Spain in the summer and have 240W of solar panels on your LV, you could expect the panels to charge the batteries at approx. 12 Amps, easily charging the batteries to capacity during the course of a day.

In the UK, in the winter, those same panels might put hardly any charge into the batteries. But, with a suitable battery-to-battery charging system in place, the batteries could be topped up in just a few hours of driving.

What if you're parked up somewhere with not much sunlight and you don't want to drive or run the engine? It's in this situation that, if you want to run the same appliances and use the same amount of energy, you'll need to have additional battery capacity to ensure that you don't run out of electrical "juice".

**The greater your on-board battery capacity, the more flexibility you will have when staying off-grid.**

Whatever type of leisure batteries you have in your vehicle you'll need to make sure that they are charged correctly. If you don't, the time you can spend off-grid, or what you're able to do, will be greatly affected. If you bought it ready-to-roll, it will almost certainly be set up so that the battery is charged from the engine, from mains hook-up and, if you're lucky, from a solar panel.
Even so, these will probably have been installed by the manufacturer with full-service campsites in mind and they may be almost useless for serious off-gridding, especially if you're using lithium batteries.

**Charging your batteries correctly is essential for maximum performance and useful operating life. The next few pages will show you what you need.**

# Charging your lithium leisure batteries (1): from the mains.

When you have a lithium leisure battery, you won't need to rely on charging it from the mains nearly as often as you would if you had a lead-acid battery. There are several reasons for this and one of them is that, unlike lead-acid batteries, lithium batteries self-discharge very slowly, around 3% per month on average. This means that you can leave a fully charged battery for several months and not have to worry about it being flat or damaged when you go back to it.

Even so, you may want to keep your vehicle connected to mains power in order, for example, to keep the heater on or to charge the batteries up overnight.

## Choosing the right mains charger

If you want your lithium batteries to be charged as quickly and efficiently as possible, resulting in better performance and longer useful life, we always recommend the use of a lithium-compatible charger. There are various models available and the most obvious difference between models is the charging output - measured in Amps. To charge a single 100Ah battery from near empty to full overnight, a 10A or 15A charger would be suitable but for batteries with a total capacity of 200Ah or more, we'd suggest a more powerful charger.

Lithium batteries should be charged differently from lead-acid batteries and can be charged much faster without the risk of damaging them. It's preferable to use a charger with a specific lithium setting and doing so will ensure maximum performance and useful life.

For the lithium batteries sold by RoadPro, as long as the charging voltage doesn't exceed 14.4V, it's usually OK to charge them using the vehicle's built-in charger. This is not ideal though, as the batteries will probably not be fully charged and their useful life may be reduced.


The CTEK M25 is our most popular charger and we have others from Votronic and NDS, all of which are compatible with both lithium and lead-acid batteries. Charge outputs range from 15 Amps to 80 Amps. As a rule, we suggest using a charger with an output of at least 10% of the battery's Ah rating. So, for two x 100Ah batteries, a 20A or 25A charger would be ideal.

# Charging your lithium leisure batteries (2): from the alternator.

Charging your batteries when the engine is running is easy and fast if your vehicle is equipped with a battery-to-battery (B2B) charger. A B2B charger does what a 240V battery charger does but, instead of getting its energy from the mains, it takes it from the vehicle's starter battery whenever the alternator is putting in a charge.

Most vehicles come equipped with a basic charging system but they are usually not designed for lithium batteries and are of almost no use if you are going to rely on your engine to charge your batteries.

For lithium batteries, a B2B charger is essential: some new vehicles come with them already installed but most don't. A good one will not only ensure that your battery is charged more quickly but, also, much more efficiently so that the battery will last longer too.

## Choosing the right B2B charger

A B2B charger can be fitted to most vehicles, including caravans, and you'll be amazed at the difference it makes. It's essential to get the right one though. If you don't, you may as well not bother.

The most suitable charging system depends on what leisure battery, what engine and alternator you have, and what you want to achieve - how fast you want the battery to charge, for example.

CTEK, NDS and Votronic all make B2B chargers. CTEK's D250SE is popular with campervan builders: as well as charging at up to 20 Amps, it has a built-in solar regulator, suitable for panels up to 300 Watts.


Votronic have chargers with outputs of up to 90 Amps - great for bigger battery banks. For a single 100Ah battery, one of Votronic's 30A chargers is ideal.

Both NDS and Votronic have "Triple Chargers" which comprise not only a B2B charger but a mains charger and solar regulator as well. If you need to save space and want to minimize cabling, one of these could be perfect.

If you have a lithium leisure battery and a motorhome or campervan based on a Fiat Ducato (without a smart alternator), NDS have a simple but very effective device called a 3Link. This will charge the battery at up to 75 Amps without any additional equipment.


If you have a caravan, things aren't quite so simple but B2B chargers are available which work with caravans too. They won't charge the caravan's battery as fast as in a motorhome, but they do make a big difference.

To make sure that you get a B2B charger that will do the best job for you and your vehicle, it's essential to get advice from whoever will be installing it. If you don't get it done properly, not only will things not work as they should but the installation could be dangerous as well. If in doubt about the equipment that you need and how it should be installed, ask someone you can trust and who really knows what they're talking about.

# Charging your lithium leisure batteries (3): from the sun.

Solar panels are often the first thing that people think of when they consider taking their motorhome, campervan or caravan off-grid. And it's true: solar panels can be great at keeping your leisure batteries charged.

But it's easy to get the wrong idea of what solar panels do. I often get asked how many panels someone will need if they want to run a fridge or a TV or some other appliance. It's possible to run appliances directly from solar panels but you could find them switching off as soon as the sun goes behind a cloud. You could have as many solar panels as you like but, if there's not enough sunlight, they won't produce electricity.

The best way to think of solar panels is as battery chargers that work when the sun's out. The higher the Watt rating of your panels, the more energy they'll put into your battery, but remember: no sun = no (or very little) charge.

Most solar panels are made from silicon and almost all are now made using monocrystalline cells. Different makes of cell have different levels of performance but what's equally important, in terms of how well a panel will work on an LV, is the construction.
A panel made with this application in mind, should be capable of dealing with the stresses of being installed on a roof where vibration and slight bending are going to occur.

This semi-flexible panel from NDS is ideal for pop-top roofs on campervans where there's a slight curve.

One that's intended to be used on the roof of a building may be less resilient.

There are rigid panels and semi-flexible panels. Rigid panels tend to be cheaper than semi-flexible ones and, in the past, have been more robust. New manufacturing techniques have made semi-flexible panels much more reliable though, and they have the added advantage of being less than 1/3 the weight of rigid panels: ideal where weight is an issue. Semi-flexible panels are also great for use on pop-tops or other roofs where there's curvature.

Solar panels & regulators come in many different types and sizes. Be sure to get what is most suitable for your vehicle & batteries

Solar panels are available in a wide range of Watt ratings. The higher the Watt rating, the greater the output.
Panels designed for use on LVs are usually rated from around 60W up to 200W and they can be joined together so that the combined output is several hundred Watts.

This type of panel usually operates at between 17V & 25V or thereabouts. This is too high a voltage to connect directly to a 12V battery and so you need a regulator to bring the voltage down to a suitable charging voltage.

There are two main types of regulator: PWM and MPPT. PWM are cheap and adequate when the sun's shining. MPPT regulators can put up to 30% more energy into the battery and are especially effective when conditions are less than ideal: when it's cloudy for example.

Many people like to be able to check the performance of their solar panels. To do this, you need a display which connects to the regulator. So, if you have an NDS regulator, you'll need an NDS display. For a Votronic regulator, get a Votronic display.

# Choosing the right solar power equipment for your vehicle.

You can't have too many solar panels! The more you have, the more self-sufficient you'll be. When the sun isn't shining, a single 120W panel may still put out some energy - just not very much. 2 or 3 panels, will put in 2 or 3 times as much. So, if you're planning to spend time off-grid in places where weather conditions may not be ideal, you should consider having more panel-power than if you're going somewhere where the sun always shines.

Some panels work better than others: good ones should reach efficiency levels of at least 18% - 20%. Then, consider how you want the panels mounted and how you'd like them to look. There are several mounting methods: some look smart, some don't. Appearance isn't everything but would you want an ugly-looking panel stuck on the roof of your LV?

Rigid panels or semi-flexible? Consider the points above. If you need light weight or your roof isn't flat, semi-flexible may be best.

As for regulators, the only reason not to use an MPPT model is the price. They really do work much better.

**NOTE:** As with most things in this guide, correct installation is essential if your solar panels are going to work to maximum efficiency. Get them fitted by someone who really knows what they're doing. It may cost a bit more but you'll never regret it.

# 240V From Your 12V Leisure Batteries.

## Using an inverter in your vehicle:

An inverter is a device which converts the 12V DC supply from your battery to 240V AC, enabling you to run domestic appliances in your leisure vehicle, even when you're off-grid.

It used to be that inverters were expensive, big and not very efficient. Good inverters are still not cheap but they are compact and efficient enough to be a sensible option in any LV. When choosing one for yours, there are two main factors to consider:

1) **The input power rating of the appliances you want to run.**

If all you want to run on 240V is a laptop computer or an electric toothbrush, an inverter rated at 400W will be more than sufficient. But, if you want to run a coffee maker, a hair dryer or even an air-conditioning unit, you'll need to consider a 1,500W or even 2,000W model. If you want to run a coffee maker and a hair dryer together, a 3,000W inverter will be required - and big battery capacity!

An inverter allows you to use many of the appliances that you use at home, in your LV, including a coffee machine.

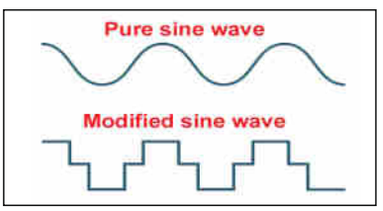
**2) The type of inverter needed to run those appliances: pure or modified sine-wave.**

Some appliances that have a simple function, such as a kettle, a light or a fan will operate perfectly well with a modified sine-wave inverter. The electricity coming out of one of these isn't smooth but square, as in the diagram.

Inverters come in two types: modified and pure sine-wave. NDS & Votronic make models with power ratings suitable for most home appliances.

Modified sine wave inverters are low-priced but they're not suitable for coffee makers, microwave ovens, laptop power supplies or electric toothbrushes! In fact, I have known these to catch fire when plugged into one.

We always recommend using a pure sine-wave inverter. The electricity coming from the sockets is smooth and almost the same as you would get from a mains socket at home or work. You'll be sure that (with rare exceptions), any appliance will run smoothly and safely.




Good quality inverters don't use much energy when they're switched on but, even so, it's worth turning them off when they're not actually being used. Remote controls are available for NDS and Votronic inverters.

## Choosing the right inverter for your vehicle.

Unless you want an inverter for a single, simple task such as boiling a kettle or running a fan, a pure sine-wave inverter is well worth the extra cost. Even if a modified sine-wave model does run an appliance such as a microwave oven (and you can never be sure it will or not), the oven will run roughly and will probably be damaged. Pure-sine wins every time.

If you want to use a hair dryer rated at 1,600 Watts, it's tempting to think that a 1,500W inverter would do. A good quality one would but you'd be straining it. It's always best to get an inverter that's rated higher than you may need so, in this case, a 2,000W inverter would probably be best. It's always better to have an inverter that's more powerful than you need than one that's only just up to the job.

The other thing to consider is whether or not you want the inverter to power all the 13A sockets in the vehicle, whenever you are off-grid. If you don't, you can plug appliances directly into the inverter or even to an extension lead.

If you do want all your sockets to be live when you're using your inverter, we strongly recommend using the Cliveway, a combination priority switch and RCD. The Cliveway has been designed and developed by Clive Mott, motorhome magazine MMM's in-house electronic expert.

Straightforward and simple to install, the Cliveway will make your inverter installation "as safe as houses".

The Cliveway

**For efficient operation and safety, correct installation of an inverter is critical: we're dealing with 240V. Get it fitted by someone who really knows what they're doing and has installed them before. Don't take chances.**

# Keeping an Eye on Your Batteries

The battery monitor that is built into most leisure vehicles is designed for use with lead-acid batteries and will not give an accurate reading when used with lithium batteries. For this reason, we always recommend using a **Battery Computer.**

A good battery computer will tell you not only the voltage at the battery but also the battery's state of charge in Amp hours and % and the rates of charge and discharge.

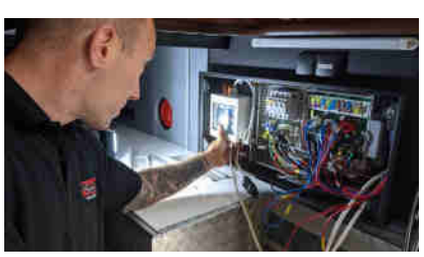
Some of our lithium batteries are equipped with Bluetooth monitoring so that you can see on your smartphone what's going on. This way of monitoring your batteries may not give as accurate a reading as a battery computer and we always recommend having one with a lithium battery installation.




# Installation

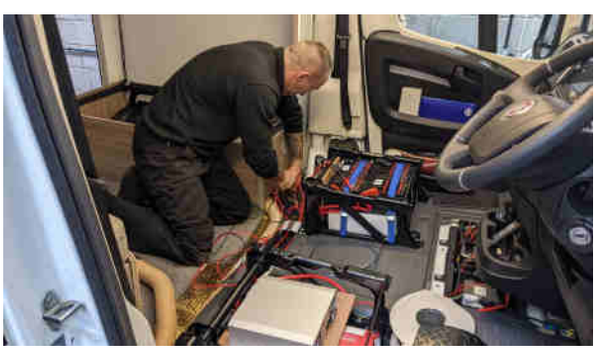
For the equipment shown on these pages, correct installation is critical. Choose unsuitable products, use the wrong cable or fuses, or even the wrong combination of battery and inverter and the whole set-up may not work as it should and as you want. That's why we always recommend using an installer who knows exactly what they're doing.

At RoadPro, we've been installing these products for many years and you can be 100% confident that, when we install equipment in your motorhome, campervan or caravan, it will be done in the best way possible. We install only high-quality products, use only the best sealants, adhesives, cable, etc and, when we've finished the job, you won't see any dangling cables or messy work.



A complete lithium battery installation can take several days, depending on exactly what's required even though we only work on one vehicle at a time.

Our customers are often surprised when they see how we manage to hide things away. It's not easy to do but we think it's well worth the effort and our customers seem to agree, as you can see from the reviews on Trustpilot, Google and our website.

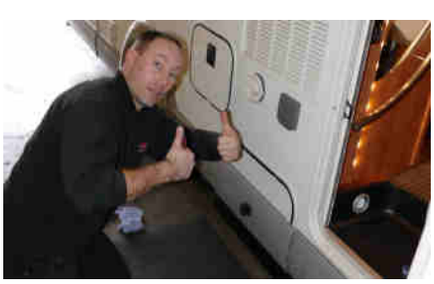


If you'd like us to get your motorhome, campervan or caravan "off-grid ready", get in touch with us via our website or email us: sales@roadpro.co.uk.

Please think long and hard about how you'll want to use your vehicle. How many days at a time do you want to spend off-grid? Where will you be and at what time of year? Will the sun be shining? What 240V appliances do you want to run when you don't have mains hook-up?

All these factors play a part in determining the most suitable products for your installation. Tell us what you want and we'll help you achieve it.

If you'd like to have our products in your vehicle but prefer to have the work done elsewhere, we work with a small number of installation companies around the UK who may be able to do job for you. However you want to play it, we will do our best to help, so that you can enjoy your "off-grid" life to the max!



# Here are the thoughts of just a few of our customers on their off-grid life.

Brian Williams has a Dethleffs motorhome and, in August, 2017, RoadPro installed 2 x 100Ah NDS 3Lion lithium batteries in it along with a 50A battery-to-battery charger. Brian wrote to us in February, 2020 to tell us how he's been getting on. This is what he says:

*Since fitting the lithiums we've done around 700 days without hook up. It's absolutely possible to manage completely without hook-up using the batteries and our 300 Watts of solar power. Out here on the Algarve we certainly don't need hook up, even in winter. We've already done over 20 days and will have completed around 70 days before we return to the UK, all without hook up and including long periods without driving the van. We even use a small fan heater on the inverter some mornings when it can be quite cool, there's no problem doing that with the two batteries.*

*The NDS 3Lion batteries replaced two AGM leisure batteries; the AGMs weren't cheap at over £500 fitted but after around 300 nights, they were clearly starting to deteriorate. If we had continued with lead acid batteries we would now be looking at a third replacement set after 700 nights, making the initially high cost of lithiums start to make sense.*

*NDS claim 2,500 cycles down to 20% capacity for the lithiums compared to around 350 cycles to 50% for the AGMs. We fitted two lithiums in order to avoid discharging them too heavily, with the result that they have rarely been used to more than half capacity. As a result the theoretical life of our lithiums is well in excess of 2,500 cycles. Even that figure provided by NDS is well over 6 times the life of good quality leisure batteries. With our NDS units currently performing at 100% capacity after 700 cycles there's every reason to believe that they will last for as long as we need them, also enhancing the resale value of our van when we decide to sell.*

*Unlike lead acid batteries, lithiums present very little resistance when charging and therefore they make the best possible use of solar output. Our battery capacity means we can wait several days until there is enough bright weather to restore our state of charge. Alternatively, a couple of hours on the road will restore our power reserves to 100% using a powerful charge from the alternator.*

*One of the benefits for us of fitting lithium batteries is that they remove anxiety about battery capacity when living off grid, even in winter. Europe is full of motorhome parking areas offering basic facilities free of charge. We use these areas much more regularly than before we fitted our lithium batteries, knowing that we can rely on our power supply and live in comfort. It's another factor when adding up their net cost, there's really no need to use expensive sites. We obviously need to be sensible about how much power we use but in practice we never need to think about our lighting, use of the TV, coffee machine, hairdryer or food processor. More often than not, our battery reserves are such that we can save gas by using an electric kettle.*

*We also have the satisfaction of using renewable energy most of the time when we're touring, our energy costs amount to no more than a few pounds worth of gas per week for our fridge and boiler. On cool mornings we occasionally use an 800 watt fan heater in preference to using our Alde heating which is excellent but which has a big appetite for gas.*

*I can say from experience that when using an inverter for mains appliances the lithium batteries are a world apart, they clearly have no problem delivering 1,000+ Watts for a kettle where our lead acid units were clearly unhappy and would often give a low voltage warning. Lithium batteries give a very stable output of around 13.2V across most of their capacity and their performance is broadly the same whether they are charged to 50% or 90% and they will happily power an inverter regardless of charge level.*
*Finally I would like to say thanks for the excellent back-up and support I have received from RoadPro. I'm happy to recommend them as a trustworthy supplier in a market where some lithium batteries are of dubious quality and where there's a certain amount of scaremongering about the supposed risks of replacing trusted technology with something less tried and tested. Having done so myself I can only say how pleased we are with the results and confirm that lithium batteries are vastly superior to lead acid technology for leisure requirements. The icing on the cake is that at some point we expect to begin making savings based on the much longer life of lithium batteries compared to the lead acid alternatives.* ***Brian Williams***

*"Thank you for the excellent service we received from yourselves when you fitted both our Lithium battery and inverter. We can't tell you how pleased we are with the performance of the battery and the workmanship of Damian. From the first quote to the welcome from Allen who went through the job with us to the fitting of the battery and the inverter were second to none. Nothing was too much trouble for Damian.*
*We have not had to use hook up since we had the battery fitted in early December. Everything RoadPro promised about the battery was true. Overnight using a compressor fridge, lighting, heating and television it did not fall below 90%. It charged back up to 100% in about half an hour of driving. We would not hesitate recommending Lithium batteries and using RoadPro to fit them. "*
***Glenn and Jennifer Jones, 29/01/2020***

*"Back in 2018 our motorhome was suffering from a very poor performing leisure battery, I was forever checking if it needed charging or dare I say connection to EHU. A call to RoadPro sales put the wheels in motion and a design and quote was sent to me (*for lithium batteries*), this being fully acceptable for what was to be installed. The motorhome was booked in and the installation completed.*
*My wife and I now have no concerns what so ever to travel Europe, for example in September 2018 we toured France and Italy, the first week only saw one EHU being used for the night because it was available! We could stop at any Aires or France Passion and know that there would be power to spare from the two 150 AH NDS Lithium batteries, solar panel and associated equipment all neatly installed by Damian, in an area not convenient for storage. We are planning trips to Scotland and then later Europe again. I'd recommend RoadPro for this quality equipment due to their exceptional expertise in the products they use and Professional installation."*
***Andy Badger, 14/01/2020***

*"I would like to thank RoadPro for their excellent work on our caravan (*we installed a lithium battery and inverter*). We are amazed at the difference already. We returned the caravan to our storage and are able to use everything with power to spare. This has never been possible before. Also the complete joy of being able to touch a switch to use the inverter for mains powered 230v equipment without the orange cable. Unbelievable! We are delighted with the professionalism, efficiency and friendliness of the team at RoadPro. We can highly recommend them to anyone requiring similar work on their Caravan or Motorhome."*
***Shirley Henshall, 07/12/2019***

*"I have had my lithium batteries fitted 6 weeks ago and have had time to give them a significant test. I was booked in at RoadPro for fitting in March, after speaking to them I was told I could arrive the night before and stay over on their car park including EHU. Next morning I drove the van inside, I was shown and told exactly what would be fitted and asked if I needed anything else. It was to be 2 x 100 amp NDS Lion batteries which includes a battery monitor colour display, Along with those we needed a mains charger to replace the vans original one, which wouldn't charge lithium's properly, so a NDS Power charger Pro was fitted. Then we had a Votronic 1715 Solar regulator fitted to deal with the 200 watt of solar we have on board, and lastly I wanted a Votronic 1250 LCD Solar Computer to monitor what my solar panels were doing. I was loaned a courtesy car for the day and off I went to do some sight seeing for the day.*
*The van was left in a state that I could stay in it overnight again, so the job could be finished the following day. The courtesy car was available for me again until I got the phone call telling me it was ready. I was shown around the installation and the display monitors, and it was a very neat job with no concerns. The staff were very knowledgeable and friendly and I couldn't have been more happy. The NDS battery monitor shows both batteries at 100% all the time whilst parked up at home with no EHU. The van battery is also fully charged by the system also.*
*We spent 5 days at Jasmin camping and with the heating, lights, and TV on each night the lowest battery state I saw was 90%, with each morning's sunshine I saw up to 8 amps being put back in resulting in 100% charge by midday. Another 5 nights covering May bank holiday saw lots of cloudy conditions, and by the end of the 4th day still using the same amount of power, I saw the battery state down to 79%. On the 5th day lots of sunshine from early morning saw the batteries back to 100% by 4pm. So 4 days in cloudy conditions saw a 20% fall, these batteries can go down to 5% and still deliver 13.2 volts, so I could possibly do 12 days off grid without any sunshine. I haven't tested the charging capability from the engine*
*So far I am very happy with the investment of £3500, yes I know you will be saying I could have had 10 batteries fitted for that, but I am not expecting to have to plug in again, and along with the inverter I should be completely independent in every situation. Thanks to the guys down at RoadPro for an excellent job.*
***Graham Woodcock, 11/05/2019***

*The team at RoadPro have fitted a new lithium battery system to our motorhome. From initial request for advice, through fitting the system and to after-sales questions they have gone over and above all expectations. On seeing the motorhome, they made suggestions that would see the system working better and make substantial reduction in the price too.*
*It has now been installed and working well for 10 days and we can say goodbye to electric hook up!*
*I am happy to recommend RoadPro to anyone.*
***Steve (Trustpilot), 21/06/2021***

Merve Gaskin enjoys the peace and quiet of a secluded campsite with as few facilities as possible. We installed a lithium battery in his Bailey caravan in 2018. When he changed his caravan in 2019, naturally Merve wanted to take the battery with him so we re-installed it in his Coachman. This is what Merve says:

*I have owned a caravan for near on 30 yrs and in all that time I have had to deal with the normal drawbacks of Lead Acid batteries. When I decided to go completely off grid around 2012, those drawbacks were magnified greatly. I had a decent panel but the weak link in the system was definitely the Lead Acid batteries! In 2018, I had had enough and decided to change to a lithium. I sourced RoadPro and asked them to fit it together with the necessary electronics. All I can say about this battery is that it has literally changed my 'on board' life.*
*Before, I couldn't run my microwave or toaster as the heavy current draw had destroyed my batteries but now all that has changed. I live virtually exactly the same as I would had I had an expensive EHU! It holds amazing amounts of power, it is about a quarter of the weight of what I used to carry around and it can take heavy discharge and recharge without damage. Without doubt, this is the greatest advance in batteries for over 100yrs and certainly the best decision I've made regarding my on board power. I simply can't see me ever going back to the EHU so sites are now much cheaper and the battery is paying me back every time I go out with the caravan. 2020 will see me paid back in saved site fees for the investment I made 2 years ago! What isn't there to like! Thanks Roadpro.*
***Merve Gaskin 09/02/20***

***You can see videos about Merve's caravan and lithium batteries on YouTube.***
https://www.youtube.com/watch?v=lNB5pCIving&t=74s & https://www.youtube.com/watch?v=W387BKgZDIo

**From D. Atkinson:**
*For my seventieth birthday I fulfilled a long-held aspiration of owning a genuine 4 x 4 Hymer motorhome with the plan of travelling wherever I wanted until my time ran out. The Hymer was purchased in Germany as a special order and delivered through a German dealer. Because of the high cost of Hymer extras and German labour charges I had the fit out done in England. After some research and advice from other long-term motorhome owners I placed a sizeable contract with RoadPro to bring the Hymer up to a high specification so that I could go off-road for long periods of time. This work included air-conditioning, satellite TV & internet, GMS communications, alarms & security, awning etc.*

*To ensure electric power self-sufficiency, I took Andrew Harris's expert advice and ordered:*
* *4 x 100Ah NDS 3Lion lithium batteries*
* *NDS 2000 Pure Sine Inverter*
* *Remote Control for NDS Inverter*
* *Votronic 1720 Solar Regulator*
* *6 x 55w MiPV Solarplex Panels*

*Since hitting the road in the early summer 2018 I have toured extensively in Northern Africa (Morocco, Western Sahara, Mauritania), Germany, Austria, Hungary, Romania, Bulgaria, Serbia, Croatia, Slovenia, crossed Northern Italy and travelled across France into Spain. As I write this review, I am in my second month of touring the Canary Islands and planning to return to the UK sometime in May 2020.*

*During my travels I have consistently tried to stay off-grid using App recommended Aires & stopping places – some of them well off the beaten track. I have only used formal campsite on occasions when I feel the need a bit of R&R.*
*Throughout my travels I have always been able to sensibly use my air-con, electric kettle, phone & computer, Dyson chargers, a large induction hob and Foreman grill. On colder winter nights I have run a small 1Kw fan heater on thermostat to save on valuable gas supplies. There have only been a couple of occasions when my battery levels have dropped to a very low status and forced me to switch off and wait for the following days sunshine. In good sunshine battery recharging seems remarkably quick.*
(There's a bit more that you can see on our website: RoadPro)
***D.Atkinson***
***Hard Parking area in Puerto Noas, La Palma 9/02/2020***

# Off grid guide FAQs

We get asked a lot of questions by people who are thinking about using their vehicles off-grid. Not surprisingly: it's a big step and, if you're used to staying on full-service campsites, it can be a daunting prospect. All the questions below have been asked – often many times – by our customers. Not all of them are about being off-grid but might be useful anyway. If you have a question that's not answered here, we look forward to hearing it! Email us at: off-grid@roadpro.co.uk.

## FAQs about base vehicles:

Q) **"I have a Swift Rio 340 motorhome. It currently has a Sargent 3 stage charger and a lead acid leisure battery. What would I need to upgrade to lithium? I may also add solar later on."**

A) **This, or something like it, is the question we get asked most often and it's impossible to give a quick and easy answer. What you need depends entirely on how you want to use your motorhome and we would never encourage you to buy lithium batteries before you've worked that out. We hope that the information in these pages is helpful!**

Q) "The Schaudt EBL99 (or Sargent/CBE/BCA/Nordelettronica etc. controller) in my motorhome does not have a lithium setting so will the lithium batteries still charge OK from the engine?"

A) As long as the on-board charger doesn't charge at higher than 14.4V, all the batteries we sell will be fine. But, charging with a dedicated 240V lithium charger is always preferable, charging faster and more efficiently.

Q) "Will the control panel in my caravan show the condition of the battery if I change to lithium?"

A) Almost certainly it won't, although everything else will work normally and nothing will be damaged. This is why, when people have lithium batteries installed, they usually have a dedicated battery monitor as well.

Q) "The starter battery in my van is lead-acid. Is that a problem if I want a lithium leisure battery?"

A) No. Every single vehicle in which we've installed a lithium battery has had a lead-acid starter battery.

Q) "Is it possible to spend a week off-grid in a caravan and still use my toaster and coffee maker?"

A) Yes. As long as you have the right batteries and the means to charge them using solar power or your towing vehicle's engine. And, as long you're not spending your entire time eating toast and drinking coffee!

Q) "Will getting lithium batteries in my motorhome invalidate the warranty?"

A) There's no reason why it should. The batteries won't adversely affect any of the components. More and more manufacturers are producing motorhomes that are "lithium ready" but they don't usually supply the batteries.

Q) "Does it matter what alternator my vehicle has?"

A) In a motorhome or caravan, the leisure battery is usually charged from the alternator when the engine is running. Almost any 12V alternator in a modern vehicle can charge a lithium battery but, if the wiring carrying the charge to the leisure battery isn't up to the job or if the voltage output of the regulator is not suitable, the battery will never reach 100% state of charge. We always recommend the use of a battery-to-battery charger and, if your vehicle has a "smart" alternator, you'll definitely need one.

Q) "My motorhome is getting on a bit: can I still install lithium batteries and is it worth it?"

A) The age of your motorhome is irrelevant as long as any equipment installed is compatible. And, yes, if you want to take advantage of the benefits of lithium batteries, it's worth it.

## FAQs about lithium batteries:

Q) "Can I use my existing lead-acid battery with a new lithium battery?"

A) No. lead-acid and lithium batteries are completely different and not compatible. Why would you want to?

Q) "Can I replace the lead-acid battery in my caravan with a lithium battery, without any additional equipment?"

A) You can but whether it's a good idea or not is a different matter. Some batteries are more suitable for this kind of application than others - check the specifications. As long as the caravan's charging sources don't put out more than 14.4V, the battery will probably not be damaged and you'll get some of the benefits of a lithium battery: more usable energy between charges, lower weight and longer life. You won't enjoy some of the other advantages, especially fast charging, without installing appropriate equipment.

Q) "Can I use a lithium battery in my caravan and charge it from the towing vehicle?"

A) Yes, we have battery-to-battery chargers designed specially to enable this and it's essential to use one if you want to put a reasonable charge into the leisure battery. However, the wiring in cars isn't designed with leisure battery charging in mind, so the rate of charge will be much less than can be achieved in a motorhome. Having said that, if you really want rapid charging for the batteries in your caravan, it can be done!

Q) “Are lithium batteries safe to use in my motorhome? I've heard they can catch fire?”

A) The batteries that are used as leisure batteries in vehicles and boats use a chemistry known as LiFePO4 – lithium iron phosphate. This type of battery is very safe indeed and, in normal use, cannot catch fire. What's more, there are no harmful gases or dangerous substances in a LiFePO4 battery.

Q) “How many lithium batteries can be connected together in parallel?”

A) It depends on the battery: some are strictly stand-alone and can't be connected to even one more. Others (including all NDS and Infinity batteries) can be connected in fours or more. Check the specifications of the battery.

Q) “Can you connect 12V lithium batteries in series to give 24V?”

A) Again, it depends on the battery, some you can and others you can’t. NDS batteries manufactured from June, 2020 onwards can be connected in series, giving 24V.

Q) “Are there different types of lithium battery and, if there are, which is best?”

A) There are three commonly used types of cell used in 12V lithium batteries: cylindrical, prismatic and pouch. They all have different advantages and disadvantages but, in terms of performance and useful lifetime, no one can agree whether one is better or worse than the others. For use in motorhomes, campervans and caravans, it’s probably not worth spending time thinking about. If you’re designing a spaceship, it may be.

Q) “How long can I expect a lithium battery to last?”

A) It all depends on the quality of the cells and how the battery is used. If it’s discharged to 10% on a regular basis, its life will be shorter than if it’s never discharged below 50%. It’s more realistic to think of a lithium battery’s life in terms of charge and discharge cycles, rather than years. A good lithium battery may have a useful life of 5,000 cycles when used moderately, avoiding heavy discharges. With heavy use, to power an inverter to run 240V appliances for example, 3,000 cycles may be more realistic. Even so, for most people, it’s not unrealistic to think in terms of between 10 and 20 years or more before a good battery needs replacing.
RoadPro has sold and installed more than 1,000 lithium batteries since 2017 and, in that time, we haven’t heard of a single battery coming to the end of its life.

Q) Is it OK to leave my lithium batteries in the motorhome, unattended for 3 months?

A) All batteries self-discharge from the moment they're left standing. A lead-acid battery could completely self-discharge within a few weeks and be damaged, as a result of sulphation.
Lithium batteries lose charge more slowly, around 2-3% per month. Recommendations vary between manufacturers but NDS say that, if they start from a fully-charged state, 3Lion and Tempra batteries can be left unattended for many months without damaging them. If the batteries are being charged from solar panels or from mains hook-up, it's essential that the solar regulator and the mains-powered charger are compatible with lithium batteries. This will avoid possible damage from overcharging.

Q) “Some people say that lithium batteries should be kept at a state of charge between 50%-80%: Is that true?”

A) It may be true in theory but is difficult to achieve and probably makes hardly any difference in terms of maintaining the efficiency and performance of a battery. What’s much more important is how the battery is charged and discharged.

Q) “Is it true that lithium batteries shouldn't be charged when the temperature is below zero degrees C?”

A) To be accurate, the cells in lithium batteries will not accept a charge at temperatures below zero. If they are subjected to a high charging current, they can be damaged. Some batteries have temperature protection built in. But this is why we always recommend using lithium compatible charging equipment which use temperature sensors to protect the battery should the temperature drop to below zero. at low temperatures to avoid harming the cells.
We have never heard of a battery being damaged as a result of charging at low temperatures, even when people have spent weeks off-grid in ski resorts. If you’re concerned, we have batteries that come with built-in heaters that come on automatically if needed.

Q) “We use gas for the fridge, heating and cooking in our motorhome, but it’s getting difficult to find LPG and it’s going up in price all the time. Is it possible to run our appliances from batteries and not use gas at all?

A) Good question! With LPG becoming more expensive and harder to find, going electric is becoming more and more attractive and it’s lithium batteries that make it possible. At RoadPro, we’re in the process of converting our motorhome to all-electric, with a 12V fridge, cooking with an induction hob and microwave powered by an inverter and using diesel for heating.
This isn’t an easy task to undertake and it’s not cheap either but, for some people it can make sense and we think that it can be a worthwhile modification, depending on the vehicle and the user’s requirements.

Q) "Can I run an air conditioner without 240V hookup? We have the usual appliances on board, including: hot water heater, pump, heating, oven, microwave, hair dryer, kettle, toaster and TV. We have 1 solar panel fitted with no extra space for anymore due to satellite dish and air-con unit."

A) Yes you can and we have helped several people achieve this. We've even installed air-conditioning in a small van used for carrying dogs. Of course, you'll need a substantial battery bank and powerful inverter to run an air-con unit: think in terms of 400-600Ah of lithium battery and a 2kW or 3kW inverter.
Running any electrical appliance from batteries is quite feasible with the right equipment and you can read about someone whose motorhome had similar requirements on page 16. Because you don't have space for many solar panels, you may need to run your engine to charge your batteries: for rapid charging, we'd recommend a 90 Amp B2B charger.

Q) "Why does my lithium battery shut down when I connect the inverter?"

A) When an inverter is connected to a battery, the inverter will draw current from the battery to prepare itself for the job of converting 12V to 240V. The inverter can - for just a few milliseconds - pull hundreds of Amps from the battery and, in some cases, the battery's BMS will switch off to protect itself. All the batteries and inverters that RoadPro sell are compatible with each other and this issue will not occur.

Q) "Why do lithium batteries vary so much in price?"

A) There's a wide range of pricing for lead-acid batteries too and the reason is the same: different qualities, designs, materials and construction. Cheap batteries of both types are usually fine for light-duty use such as running lights and TVs for example. For heavier-duty use, including powering an inverter, a better, more expensive battery will probably be more efficient and will last longer.
Some batteries have features such as Bluetooth and those in the NDS Tempra range have built in communication devices so that they "talk" to each other and to the various connected charging devices. Built-in heaters and specially-made cases also make some batteries more expensive than others.

## FAQs about battery-to-battery (B2B) charging:

Q) "What does a battery-to-battery charger actually do and should I get one fitted to my vehicle?"

A) A B2B charger performs the same function as a 240V battery charger but gets its power from the vehicle's alternator, via the starter battery. They're useful to have if you want to charge your leisure batteries more efficiently and faster whenever the engine is running.
If your LV (towing vehicle if you have a caravan) has a smart alternator, you definitely need one. Some manufacturers fit them at the factory but most don't, opting for a special relay instead. This will charge the battery but not nearly as well as a B2B charger.

Q) "Will a B2B charger damage my alternator?"

A) Not if you have a suitable charger, it's been installed correctly and the alternator is in good condition.

Q) "How do I know which B2B charger will be best for my LV?"

A) Chargers come with different output ratings. A 90 Amp B2B charger will charge 3 times faster than a 30 Amp one. Some B2B chargers, such as the CTEK D250SE have a built-in solar regulator and some Votronic and NDS models charge not only from the alternator and the solar panels, but from 240V EHU up as well. These are ideal for use if you're building a campervan from scratch.

Q) "Can a B2B charger charge the starter battery as well?"

A) All Votronic B2B chargers will send a charge to the starter battery when the leisure battery is fully charged.

Q) "I keep hearing about D+. What is it?"

A) The D+ connection is an electrical terminal which is always live when the vehicle's engine is running. It's used by battery-to-battery chargers to tell them what they need to do and by 3-way fridges to tell them that they can run on 12V. In older vehicles with a B2B charger, the D+ signal wasn't so important because the charger could be controlled by the change in voltage at the starter battery, when the engine was running. With the introduction of "smart" alternators, this is no longer the case.
In vehicles where there is no D+ available, ignition+ can be used. This connection tells the B2B charger that the ignition is on, even when the engine isn't running.

Q) "Will the condition of my starter battery affect the performance of my B2B charger?"

A) It can do. If your starter battery is in poor condition, we would always recommend replacing it anyway but, if you have a B2B charger, there's even more reason to do so.

## FAQs about solar panels:

Q) "Can I use panels designed for buildings on my campervan?"
A) Panels intended for use on buildings tend to have outputs of around 250 Watts or more. That sounds good but these are big panels that may not fit on the roof of a campervan. They usually operate at between 24V & 48V so a suitable regulator is needed. Both these factors can make domestic panels difficult to use on vehicles and boats.

Q) "I was told that a 100W, 12V solar panel will charge the battery at only 5 or 6 Amps. Is that right?"
A) It is right and here's why. There's no such thing as a 12V solar panel: most panels designed for vehicles work at a voltage in the range of 17V–21V. So, to work out the Amps that a 100 Watt panel might produce, you need to divide 100W by the panel's voltage – 19V for example - which gives you just over 5 Amps on a very sunny day using a PWM (pulse width modulation): perhaps 40-50 Amps during the course of a day.
The type of regulator being used makes a big difference: an MPPT (maximum power point tracking) regulator will put up to 30% more energy into the battery.

Q) "What about portable panels?"
A) Portable panels can work very well because any solar panel will work best when it's pointing directly at the sun. To get the most out of a portable panel, you'd have to move it every few minutes. That's after you've taken it out, set it up and connected it to the battery: it's a lot of faffing about. Because, most of the time, they're not pointing directly at the sun, roof-mounted panels are less efficient but, because they're always working, they'll usually put more energy into the batteries in the long run.
A word of warning: If you enjoy spending your days keeping an eye on the position of the sun and adjusting your portable panel accordingly, get a good security system for it, just in case you look away: thieves love them!

Q) "Which solar panels are better: rigid or semi-flexible?"
A) It all depends what you want to get from your solar panels and both types have advantages. If you want the very highest efficiency, NDS SolarFlexEvo fit the bill. But the difference in a real-life situation will hardly be noticeable. If you want to save weight, semi-flexible panels are a lot lighter than rigid panels and they come in smaller sizes. If you have a campervan with a pop-top, a semi-flexible panel is a must and we have special ones with the junction box on the back of the panel. The look great, as you can see in the photo on page 9.
Rigid panels are cheaper and almost as efficient. They are available in higher power ratings – up to 180 Watts and in different finishes: the NDS "BLACKSolar" panels look amazing!

Q) "In bright sun, my semi-flexible panels get so hot that I can't touch them. Doesn't that damage them or stop them working properly? Are semi-flexible panels reliable"
A) A good-quality semi-flexible panel, such as those from NDS, is designed to operate between -40°C and +95°C. NDS SolarFlexEvo panels are fitted as standard equipment by Adria, who conducted extensive testing before choosing to use them on their motorhomes. Beware of panels constructed using aluminium sheets and cheap, poor-quality panels: if they've been stuck down and they stop working, they can be very difficult to remove from a roof.

Q) "Can my solar panels charge the starter battery as well as the leisure batteries?"
A) Yes. NDS and Votronic solar regulators can be installed so that they charge both batteries.

Q) "Is it best to connect multiple panels in series or in parallel?"
A) There might be some advantages in connecting panels in series in certain situations. For 99% of installations on leisure vehicles though, connecting in parallel makes much more sense and is what we always do.

Q) "What size solar panel do I need to run my fridge?"
A) If you were in a place where bright sunlight was guaranteed 12/7, you could indeed run a 12V fridge directly from solar panels – through a regulator, obviously. But, the chances are that you're not going to be and, for this reason, it's better to think of a solar panel as a battery charger and not as a way to power appliances directly.

Q) "Why do I need a regulator and why should I get an MPPT version?"
A) The voltage coming from a "12V" solar panel is usually between 17V – 50V, so panels can't be connected directly to a 12V battery. Maximum Power Point Tracking can increase the current going into the battery by up to 30% and this type of regulator is especially effective when the sky is cloudy or overcast.

Q) "Are your panels mono-crystalline or poly-crystalline?"
A) Mono-crystalline since you ask but, to be honest, you wouldn't notice much difference in the performance of the two types unless you were using scientific instruments. It used to be that poly-crystalline panels were significantly less efficient than mono-crystalline ones but, these days, that's not the case.

Q) "I saw a video on YouTube where an installer says that the panel he's fitted "is effective without sun light". Is he right – can you get solar panels that don't need sunlight?"

A) I've seen that video too and I asked the installer why he was saying this. He hasn't replied and my comment was removed! The fact is that, at the moment, you cannot get solar panels designed for use on vehicles that generate electricity without direct sunlight. A good-quality panel will produce some energy even in cloudy, overcast conditions and some are more efficient than others. But, if the panel is indoors, something is blocking the sun or the sun is below the horizon, it will not work, no matter what anyone on YouTube says.

Q) "In that same video, the installer has placed the panel very close to a TV aerial. In certain positions, the aerial will throw a shadow on the solar panel. What effect would this have?"

A) Anything that blocks direct sunlight from hitting a solar panel will create shade. In silicon panels (almost all those used on leisure vehicles), even if only a few of the panel's cells are shaded, the energy sent to the battery can drop by 50% or more. This is because of the way solar panels are constructed, with the cells connected in strings. For maximum performance, no shade should fall on a solar panel, even from a TV aerial.

Q) "Not a question about solar power but, can I use my fuel-cell to charge lithium batteries?"

A) Unfortunately not and, even if you could, it probably wouldn't be worth it because of the low charging current.

## FAQs about inverters:

Q) "Modified sine-wave inverters are cheaper than pure-sine models. Can I use one to run my microwave?"

A) You can try but there's no knowing if it will work until you switch it on. Even if it does work, you will almost certainly notice that the microwave runs roughly. This means that it is not working efficiently, and this can result in the oven being damaged and having to be replaced.
The only way to be certain (well, almost certain) that your appliances will work as they should, is by using a pure-sine wave inverter. We have seen – just once – a microwave oven in a motorhome that would not run with a pure sine-wave inverter. We checked an identical oven in another motorhome and it worked perfectly. That's electronics for you.

Q) "How efficient are inverters? How much electricity do they consume when they're in use?

A) All inverters consume electricity when they're powering an appliance. A good quality inverter will be around 90% efficient. So, if an appliance uses 1,200W the total Watt rating, including the inverter, would be 1,320W, taking 10% more out of the battery than you might think.
As a general rule, the more expensive the inverter, the better the design and the components. A good inverter will be more efficient than a cheap one, which could have an efficiency of less than 70%, taking a lot more energy out of your batteries than you might think. "

Q) Do inverters take anything out of the battery when they're on but not in use?"

A) Yes, they do and it's called the quiescent current. It can be significant, so always keep an inverter switched off if it's not being used. Most inverters can be connected to a remote switch for convenience.

Q) "If possible, I would like a system that automatically knows if the motorhome is hooked up to power or if it needs to use the inverter. The less we need to press buttons and switches, the better."

A) That's easy! All you need is a priority switch which sends power to the vehicle's sockets from EHU when it's available and from the inverter when it's not. There are no switches or buttons involved. We have separate priority switches as well as inverters with priority switches built in. The only tricky bit is actually connecting it all up. It's time consuming and it has to be done correctly. Leave it to a competent installer.

Q) "Do I need a separate RCD for my inverter?"

A) If you're connecting appliances directly to the inverter's output socket, even to an extension lead that's plugged into the inverter, manufacturers such as Votronic say that an RCD for the inverter is not necessary. If the inverter is connected directly to the sockets built into the vehicle, Votronic and other experts say that you should use an RCD. The use of electricity in a motorhome, campervan or caravan is a complicated subject and different experts do seem to have different opinions on the matter. Bearing in mind that electricity should always be approached with caution, we suggest using a device such as the "Cliveway", which will ensure that your inverter installation will be "as safe as houses".

Q) "What size inverter do I need to power the charger for my electric bike/hair dryer/etc?"

A) Every appliance comes with a label on it that gives its Watt rating. That figure tells you the power output that your inverter will need. If in doubt, get an inverter with a higher rated output than you actually need – at least 25% higher. This will ensure that the inverter runs comfortably and is well within its operating capacity. Don't try to save money by getting one that is just about good enough, especially if you're going to be using it often.
One more thing, if you only need to run an appliance rated at 400W, there's no point getting a 1,500W inverter. A large inverter takes a lot of energy just to work and will take a lot more out of the battery than a 600W model.

Q) “Is it possible to run air-conditioning from an inverter?”
A) Yes, it is and we have installed several systems to do just that. But, as well as a 2,000W inverter, you will need a lot of high-quality batteries, preferably lithium.

Q) “Can I run my CPAP machine from an inverter and, if so, what size and type will I need?”
A) We have supplied a lot of inverters to people to do exactly this. Some CPAP machines use as little as 100W or less, others use more. Check yours to be sure and get a pure sine-wave inverter that can give the power the machine requires. Obviously, get a good-quality inverter: your life could depend on it!

Q) “Can I connect the inverter to my motorhome's battery charger, so that the inverter charges the battery?” (We have actually been asked this question.)
A) No! Think about it. If you could do this, you would have solved the world's energy problems and defied the laws of physics in the process. This doesn't stop one company we know of from installing inverters in exactly this way.

## FAQs about installation:

Q) “Do you do installations?”
A) Yes we do. Anything that we sell (apart from TESA AutoLift levelling systems), we can install and we have one of the finest installation engineers in the country working with us. Our chief installation engineer Damian specialises in electrics and has installed hundreds of lithium battery systems, solar panels, chargers and inverters in all kinds of motorhomes, campervans, caravans and other vehicles. You can see what our customers think of our work on Trustpilot and in Google reviews.
We also work with several installation companies around the UK who can fit our equipment. Tell us where you live and we’ll help you find one.

Q) “I bought a cheap lithium battery and some solar panels on eBay. Can you fit them for me?”
A) No, we only install products that we have supplied. That way we can be 100% certain that everything will function as it should and we can take full responsibility for the work.

Q) “I can get things installed for much less money by another company. Can you match the price?
A) Installing equipment so that it's efficient, safe and neat takes time and can't be done on the cheap: at least, not by us. If low price is more important to you than a first-class job where no cables are visible, the roof doesn't leak, the installation is safe and bits don't fall off, you'll have to look elsewhere. We can give you some names.

Q) “Can you come to my house to do the installation?”
A) No, we only work on vehicles at our premises in Daventry. Why? Because the work we do can be very complex indeed and every vehicle is different. In our workshop we have everything we need to cope with (almost) any situation. If a customer suddenly changes their mind and wants 3 batteries instead of two, or a 175W solar panel instead of a 100W model, we can accommodate them. And, you wouldn't want us making holes in your roof while it was raining, would you?!

Q) “I want a solar panel but I don't want you to make any holes in my caravan's roof. Is that possible?”
A) No, it's not possible. Even if we glue the panel to the roof, we still need to make a hole for the cable. Honestly, there's nothing to worry about. Since we started doing installations, we must have drilled well over 12,000 holes in people's treasured motorhomes, caravans and campervans. So far, we've not had a single complaint or report of water ingress! As long as the work is done properly, there's nothing to worry about!

Q) “Can you install only a WiFi system for me?”
A) Unfortunately not. We don’t really fit individual products (except for rear-view cameras). We specialise in full system installations, especially to enable our customers to use their vehicles off-grid. It’s difficult to fit small jobs - such as installing a WiFi system - into our work schedule.

Q) “Sorry to have so many questions but just want to ensure that everything will work properly and be installed correctly to justify the investment.”
A) Ask away. We understand that spending thousands of pounds on transforming your motorhome is a serious commitment and we want you to understand exactly what you'll get for your money. You tell us what you want and we'll make sure you get it. You can rest assured that we have been installing lithium batteries, inverters, solar panels, chargers and much more in motorhomes and other leisure vehicles since 2015 and we have yet to hear from a single customer who has regretted asking us to do the job for them.

**Find out more about our products and our installation service at** https://www.roadpro.co.uk

ROADPRO
Practical Products on the Move

# There's never been a better time to go off-grid.

It's true, there's never been a better time to go off-grid. As Merve Gaskin from the Caravan & Motorhome Off-Grid Group (CAMOGG) on Facebook says, you don't need to rough it or go back to basics. Going off-grid these days is all about freeing yourself from that orange lead and not having to rely on mains hook-up to enjoy yourself in your motorhome, campervan or caravan.

At RoadPro, we've been helping people to get off-grid for years and we've never heard a single customer say that they wish they hadn't done it. If you'd like to find out how we can help you prepare your vehicle so that it's off-grid ready, get in touch with us, either via email or using the "contact us" form on our website. If you're not sure about going ahead, relax: you're in safe hands at RoadPro. Below are some of the comments on our installation service that our customers have posted on Trustpilot.

Trustpilot
FIVE STAR REVIEWS ★★★★★

**So impressed with the professionalism: Anita & Mark, November 2021.**
*So impressed with the professionalism of all the team. They completed over 3 days a complete upgrade to enable our motorhome to be free from any EHU requirement, with solar, B2B, and inverter. Tremendous communication and installation. Definitely the best and worth waiting 3 months to have them install as only want to do this once!*

**Excellent customer experience: Leo, December 2021.**
*Right from the off they efficiently walked through my requirements and designed a solution to deliver them. At that point I was considering a number of different providers and RoadPro pretty much blew them away.*
*I eventually had lithium, blacksolar/regulator, battery to battery, mains charging, inverter, vehicle trickle charger installed so it was quite a big job. Only downside was the wait to get a installation slot.*
*The installation itself was excellent: thoughtful equipment/panel positioning and neat clean wiring with no internal/external impact to the look of the motorhome.*
*I'm a full timer so the equipment gets used all the time. Zero problems. I understand why they are so booked up.*

**Lithium Upgrade: Holly, January 2022.**
*My 3rd visit for full off-grid motorhome upgrade to lithium c/w B2B charger, sine-wave invertor & cab battery conditioner with 240v dist. Well specced, quality kit, tidy install and a relaxed wait. Well pleased with the result, thanks RoadPro.*

**The team at RoadPro have been excellent: Steve, January 2022.**
*The team at RoadPro have been excellent throughout the process of choosing and installing a lithium battery system into our motorhome. We have just returned from a six week holiday in France and Spain (luckily avoiding the border lockdowns due to Covid) and on the trips down and back we stopped at aires, exploring new places. Even with the heating, fridge and lights on, and using the inverter for our power hungry laptop, the batteries were never less than 75% in the morning. They were also quickly recharged by the B2B charger as soon as we started driving. We would certainly recommend RoadPro to anyone.*

**Seeking more off-grid autonomy: John, February 2022.**
*Seeking more off-grid autonomy, I turned to RoadPro to fit two lithium batteries and a battery-to-battery charger, a task requiring a degree of inventiveness given the limited under-seat space available. They did a first rate job advising me on available equipment and fitting. Very nice people to work with!*

## Just a couple more comments.

*"RoadPro's service is second to none."*
Rodney Lambert, Vice Chairman, Caravan & Motorhome Club.

*"I can't thank RoadPro enough for having done such a fantastic job. I would recommend them to anyone contemplating ways to improve their motorhome. 5 star rating."*
John Lawrence Bsc MPhil CChem MRSC CSci FCMI FISBL

## To place an order, find a dealer near you or arrange installation, email us or visit our website.

**RoadPro Ltd:** 3 Egerton Close, Drayton Fields, Daventry, NN11 8PE
**E-mail:** sales@roadpro.co.uk

# www.roadpro.co.uk

We're not just a website. You can see our range of accessories in action in Daventry. Get in touch with us to arrange a visit.

ROADPRO

www.roadpro.co.uk

# We know what works because we use our products ourselves, in the RoadPro Rapido.

You've spent a lot of money on your van and you probably don't want to spoil it by fitting second-rate accessories. If you do, recycle this leaflet now!

But, if you're looking for high quality accessories that will work well and last for many years, **RoadPro** can help. We have a great range of products to help you get the most out of your off-grid life: lithium batteries and everything you need to charge them correctly as well as solar power systems, monitors, inverters, rear-view cameras, MaxxFans and much, much more.

**We use these products in our own van so that we can be sure that everything works as it should, and you know that they'll work in yours.**

# Leaders in Lithium

If you want to be more independent and free to go wherever you want in your van, come and talk to us. Whether you want to wild-camp for days (or even weeks) on end or just use your coffee maker whenever you feel like it, we have a range of lithium batteries that won't let you down.


Everyone and his brother seem to be selling lithium batteries, so how can you tell what's going to be the best one for you? For a start, where are you going to put your battery? Will it fit under the seat of your van? We have batteries that measure just 190mm in height and putting a battery under a front seat will give you more space in the living area.


What Amp/hour capacity do you want? The higher the capacity, the longer you'll be able to stay off-grid.

We have batteries with Ah capacities ranging from 30Ah to 150Ah. Soon, we'll even have a 150Ah battery that will fit under the front seat of your van. Fit two and have 300Ah of energy to power your van as well as 240V appliances (with an inverter).

How much power do you need your battery to provide? That depends on what appliances you want to run from it. Get the wrong battery and you could be making an expensive mistake.

We've been selling and installing lithium batteries since 2015 and we know what will work and what won't. For several reasons, buying the cheapest battery isn't usually a good idea but buying a high-priced battery may not be worth the expense. Our batteries - from PowerRoad and NDS - combine reasonable prices with excellent performance and high reliability, ensuring thousands of charge and discharge cycles in all conditions.

**Find out more in our Guide to Lithium Batteries: it's in the product guide section of our website.**

# Solar Power for Your Van

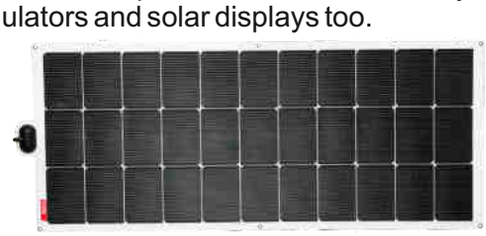
Putting solar panels on the roof of your van is essential if you want to make the most of going off-grid. As with batteries, what sort of panel/s will be best for you depends on various factors including what type of roof you have and how much space is available.

We have around 20 different solar panels to suit almost every van plus, of course, regulators and solar displays too.

**Semi-flexible with back-mounted junction boxes - ideal for pop-tops. 105 Watt - 200 Watt**

**Rigid panels with built-in mounts. 85 Watt - 180 Watt**

**Solar power monitors**



**Semi-flexible panels with front-mounted junction boxes. 60 Watt - 195 Watt**

**For more information on these products, visit our website:**

**www.roadpro.co.uk**

# Votronic 12V Products - Made for Campervans

VOTRONIC
MADE IN GERMANY

Votronic is the world's leading manufacturer of 12V products designed specially for campervans and motorhomes. They make a wide range of products which are used by many European motorhome manufacturers and self-builders around the world. If you're looking for high performance in all conditions, combined with maximum reliability, check out the Votronic range.


## Control Panels


## Tank Sensors


## Solar Regulators 165W - 530W


## Solar Computers

## Mini RCDs


## Pure-Sine Inverters 400W - 1,700W


## Battery Computers


## Battery Chargers 15A - 80A


## Triple Chargers 30A - 60A



## Battery-to-Battery Chargers 20A - 90A

For more information on these products, visit our website:
www.roadpro.co.uk

# NDS 12V Products - Made for Motorhomes

NDS is an Italian manufacturer known for their range of 12V products, designed specially for campervans and motorhomes. Products include triple chargers, inverters, solar regulators, battery monitors, AGM and lithium batteries and the biggest range of solar panels on the market.
You can see the whole range and the NDS catalogue on the RoadPro website.


**AGM Batteries**
**90Ah - 140Ah**


**LiFePO4 Batteries**
**20Ah - 150Ah**

**Solar Panels**
**50W - 200W**




**Battery Computers**

**Pure-Sine Inverters**
**400W - 3,000W**


**Solar Regulators**
**320W - 350W**

**Power Service PSB DC-DC Chargers**
**40A / 60A / 80A**


**Triple Chargers**
**30A/40A Engine**
**+**
**20A Solar**
**+**
**20A EHU**


**For more information on these products, visit our website:**
**www.roadpro.co.uk**

# CTEK Chargers - “Maximising BatteryPower”

CTEK
MAXIMIZING BATTERY PERFORMANCE

The CTEK D250SE is probably the best selling battery-to-battery charger in the world. It not only charges your leisure battery at up to 20A, it also has a built-in solar regulator that can be used with solar panels rated at up to 300W. It’s compatible with both lead-acid and lithium batteries.
RoadPro is CTEK’s specialist distributor for “integrated charging” products but we also stock 10A and 25A mains chargers plus the CTEK Battery Sense, an app-based monitor for all lead-acid batteries.


**CTEK D250SE**
**Battery-to-Battery Charger**


**CTEK M25**
**25A 240V Charger for lead-acid and lithium batteries**


**CTEK MXS10**
**10A 240V Battery Charger**


**CTEK CTX Battery Sense**
**Battery Monitor**

# Pro Car - “When You Need Secure Connections”

PRO CAR
AUTO- UND BOOTSZUBEHÖR

Pro Car 12V/24V plugs, sockets and adaptors are used by vehicle manufacturers all over the world. That’s because the quality is the best and the range of products covers just about every requirement.
See our website for the whole range, including high-power USB sockets for both USB “A” and “C”.


**For more information on these products, visit our website:**
**www.roadpro.co.uk**

# MaxxFan Deluxe - “Keeping You Cool”


## Maximum comfort in your motorhome - all year round.

The MaxxFan is a great way to keep cool in your campervan, motorhome or caravan. It will fit it a standard 40x40 roof window and can be left open, even when it’s raining. There’s a variable speed fan, a thermostat and a choice of sucking cool air in or blowing stale air out. And it’s all operated by a neat remote control. Once you’ve tried one, you’ll never want to go without again.
The MaxxFan is available with a choice of covers: smoked and clear.

## No room for a MaxxFan Deluxe? Here’s the MaxxFan Dome.

When you need an extractor fan in the bathroom or kitchen of your campervan, motorhome or caravan but there's not enough space for a full-sized Maxxfan, the Maxxfan Dome could be exactly what you need. Available in white and black, with or without LED lighting, the Maxxfan Dome can be installed on a roof or a side-wall and needs a space of only 220mm in diameter. The Maxxfan Dome runs on 12V and is simple to install and use. See the information sheet on our website for more information.

## Whatever you’re installing on your campervan, use Dekalin products for total security and a watertight finish.



Superb bonding properties, great tensile strength, resistance to aging and the elements, and high UV resistance - these are just some of the advantages that Dekalin products offer.

DEKALIN

**For more information on these products, visit our website:**
**www.roadpro.co.uk**

# TESA AutoLift - “The 12V Self-levelling System”

## Self-levelling for campervans & motorhomes.

The TESA AutoLift is the only levelling system that uses electro-mechanical jacks rather than hydraulics. There are several advantages, not least the fact that the price is much, much lower.

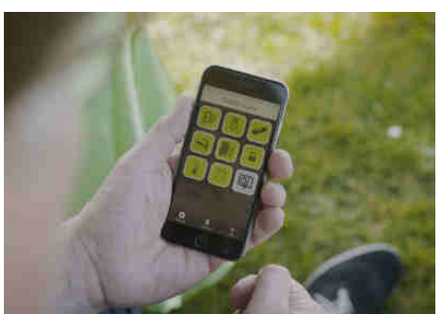
Made in Italy since 2011, the TESA system is sold all over Europe and has been fitted to thousands of motorhomes and campervans. Proven reliability, ease of use and, of course, reasonable pricing have made it a popular choice.

Using specially made mounting brackets, the system can be installed on most motorhomes with a GVW of up to 5.5 tonnes.

# E-Trailer - “The App-based Information Centre”

## Making your vanlife easier and safer.

E-Trailer is the award winning (Practical Caravan "Accessory of the Year" award) smartphone app for safe and comfortable journeys with your campervan, caravan or motorhome. Designed in Holland, E-Trailer is easy to install, simple to use and makes life easier and safer both when you're travelling and when you're on site. It can be used with any campervan, caravan or motorhome, no matter what age or model.



E-Level makes it quick and easy to get your vehicle level, using the app on your phone.

Tyre pressure module (E-Pressure): this enables you to keep an eye on the tyre pressures on your caravan.

Battery monitor module (E-Volt): monitors your caravan's leisure battery and alerts you when the voltage drops.

Switch module (E-Switch): before you set off, E-Switch warns you if doors or windows have been left open.

Temperature module (E-Temperature): constantly monitors the temperature in your fridge or in the caravan - depending on where you place the sensor.

Gas level module (E-Gaslevel): works with steel and aluminium LPG bottles and accurately gives you the current level.

Water level module (E-Waterlevel): can be installed in most water tanks and gives an accurate reading of the amount of water in the tank.

**For more information on these products, visit our website:**
**www.roadpro.co.uk**

# CAMOS "Jewel" Rear-View Camera Systems

## The neatest, cleverest rear-view camera system ever! Ideal for motorhomes & campers.

CAMOS "Jewel"

Being able to see what's behind you when you're driving is essential if you're a safety-conscious driver. Up until now, if you wanted a camera system that looked back down the road when moving forward and also down to help when reversing, you had two choices: an expensive motorised camera or a bulky, clumsy looking twin-camera unit. Both systems do the job but there's a neater, less obtrusive, yet reasonably-priced alternative.

The new "Jewel" system from Camos uses clever software combined with a compact, high-quality camera and a choice of monitors: neat, high-resolution dash-mounted models or one that clips onto an existing rear-view mirror.

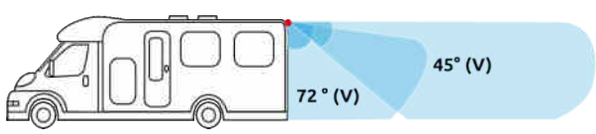
## A choice of 3 monitors & two cameras

Jewel camera V1

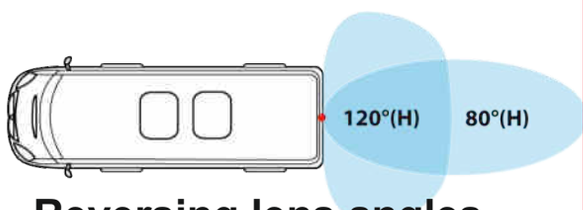
"Jewel" systems are available with a choice of monitors: 5" & 7" dash-mounted models and a mirror-mounted version that clips onto an existing rear-view mirror.

There's a choice of cameras too: The V1 has a stainless-steel housing and a small amount of adjustment available. The V2 is enclosed in a heavy-duty plastic housing with a silver finish. This model is ideal when the camera is mounted on a vertical surface. Whichever combination of camera and monitor you choose, you'll get the same dual images from the camera as shown below.

Jewel camera V2




Driving lens angles




Reversing lens angles

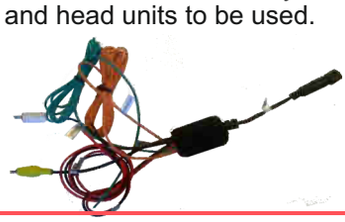
OneView camera

There are two more cameras in the Camos range: the OneView which has a single lens and a microphone and the CM-49, a twin-lens camera which also has a microphone. They can both be used with the same cable that comes with the Jewel.

CM-49 camera

**Want to use a monitor with phono connections?**

We have an adaptor cable for converting a Camos camera lead to phono connectors. This enables a variety of monitors and head units to be used.



ADRIA®

Adria motorhomes from 2015 onwards (except Twin & Sun Living models) have Camos camera cables installed at the factory, making installation simpler and quicker. Most Camos rear-view cameras can be used with the cable including the "Jewel" systems.

# What Can We Do For You And Your Van?

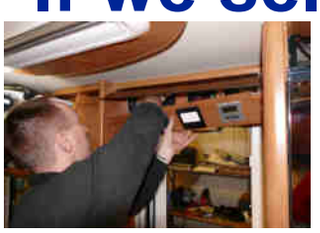
If you're interested in using any of our products, it really doesn't matter what type of van you have: motorhome, campervan, caravan, big, small, old or new: we can help you get the most out of it. But we try to make sure that you get what you need, not just what we would like you to buy.
We work with most of the main campervan builders as well as many of the smaller one so, if you're having a van built, you can ask them to fit any of the products in our range.
If you're a self-builder, you can buy our products from a number of on-line retailers and installers around the country. So, if you like our products but don't want to fit them yourself, you can ask an installer to do the job for you.
We have an installation workshop ourselves and you're welcome to get in touch and discuss your requirements with us. But, be warned: we'll never get you in for installation work until we know exactly what it is that you want to achieve and we've explained how we can make it happen. That way, everyone's happy.

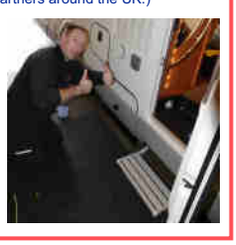

Trustpilot
FIVE STAR REVIEWS
Google Reviews

**If you worry about getting installation work done on your motorhome, see our reviews on Trustpilot and Google. They'll set your mind at rest!**

## If we sell it we can install it.

(Except for TESA AutoLift, for which we work with installation partners around the UK.)

Find us on Facebook

Facebook is a great way to keep in touch and to share information about what's going on.
We add regular posts to let our followers know about shows, new products, technical tips and more.
So, visit our page and remember to "like" it.

**https://www.facebook.com/RoadPro.Limited**

Instagram

If you use Instagram, search for @roadprouk and keep an eye on what we're up to. We like to post pics of what we're doing, what we've done, customers' vehicles and more. Don't miss out on the fun...follow us!!

**@roadprouk**

YouTube

If a picture is worth a thousand words, a video is worth a thousand pictures. That's why we're making informative videos of as many of our products as we can.
To keep informed when we post new videos, remember to subscribe.

**https://www.youtube.com/c/RoadproUK**

## To find out more about our unique range of products, to find a dealer near you or to arrange installation, visit our website

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We're not just a website. Get in touch to arrange a visit and see our range of accessories in action.