

Powering sound meters outside

Simon Bull, Castle Group Ltd

Battery technology is powering ahead under pressure of on the one hand, the need for greener energy and transportation and on the other hand, our insatiable desire for ever more powerful personal technology.

Both, as it turns out, are rather useful when it comes to powering a sound meter.

Add to that, the advances in solar power and even in the grim North, from whence I hail, it is possible to leave your monitoring equipment for weeks and months on end until that inevitable maintenance visit to change a sodden or UV degraded windshield, or to remove the weeds that have grown up the microphone cable.

So how does it all work?

Power to the sound meter

Every time there is an improvement in battery technology or a reduction in the power required by a particular processor or other component, there seems to be an equal and opposite demand on the technology. The best example is colour displays – not necessarily essential on a sound meter but nonetheless, desired by users. Add to that Wi-Fi, Bluetooth and the desire by some to record one third octave bands every ten milliseconds, in three derivations of time and frequency response, plus continuous WAV files and we are right back to a significant demand on power.

Batteries

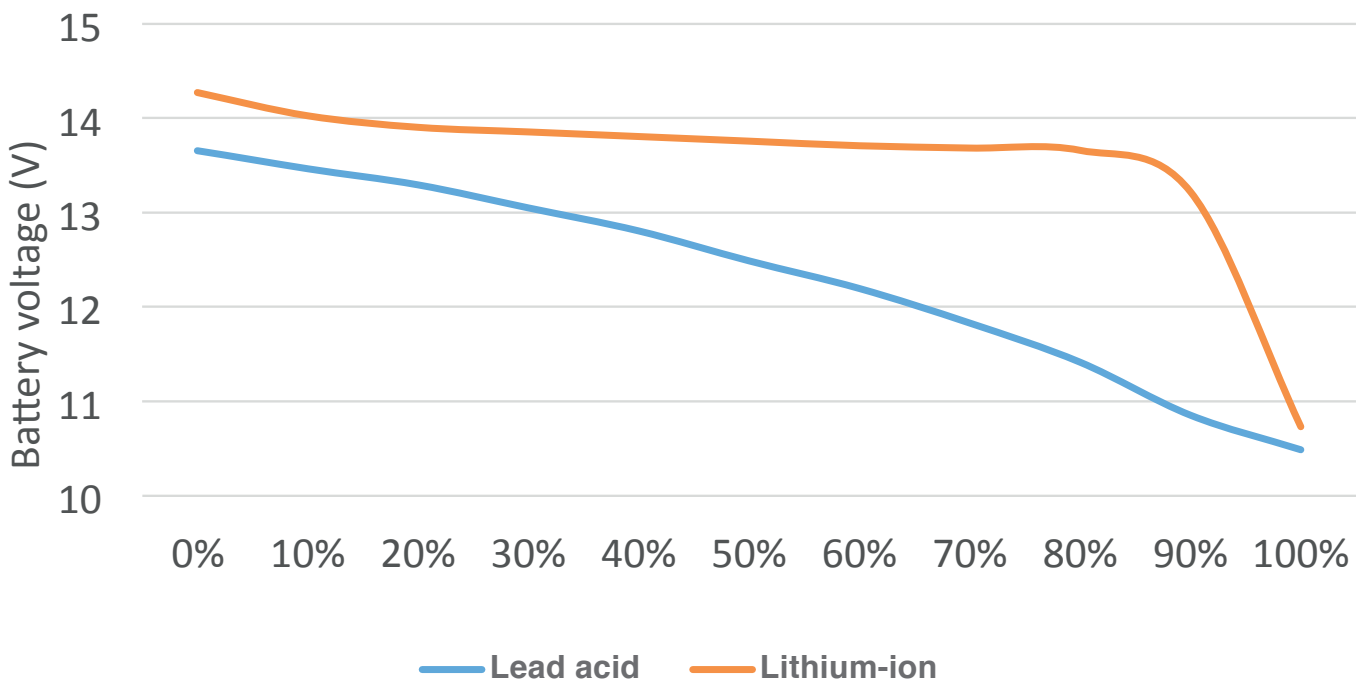
Standard AA or AAA batteries have changed little in decades and are still the preferred choice for most sound meters' internal power. Rechargeable batteries are a good idea in theory, but when you need a sound meter, you often need it ready to go. So, how about powering a noise monitor outdoors?

Until diamond batteries are truly with us (check them out online), there is a basic choice between lead-acid and lithium-ion technology and there are some useful points to consider in making this choice.

Firstly, there is a trade-off in the initial set-up cost and so deciding on your most likely application is really important.

- Lead-acid batteries will usually suffice for measurements up to a week or so depending on the size of the battery and the power consumption of the sound meter. You can extend this with an external lead acid 'leisure' battery, solar panels or regular replacement visits to site.
- Lithium-ion batteries do come with a large initial price-tag. The capacity of these batteries compared with lead-acid is huge and can extend the time two- to four-fold for the same physical size of battery. They also have a much flatter usage curve as the chart below indicates. But charging is a tricky business and portable solar panels are often not up to the job, so they are best suited to stand-alone applications where external power or solar are not available. Once again, external lithium packs are available, although these have a high initial cost. P28 ▶

Discharge curves: Lithium-ion v lead-acid



If overall cost is a consideration, then you need to compare the life-time cost between the two and there are plenty of cost comparisons online showing the overall running cost to be significantly lower with lithium batteries. The table below highlights this point, with up to 10 times the cycle life compared with about five times the cost.

Compare	Lead-acid	Lithium-ion	Difference
Length	151mm	161mm	25% smaller
Width	98mm	115mm	
Height	94mm	56mm	
Weight	4.2kg	1.25kg	3 x lighter
Capacity	12Ah	22Ah	2 x capacity
Price	£40 approx.	£200 approx.	5 x price

Battery maintenance

With all these battery-only systems, you may need to visit site to change batteries. In this case, it is important to know if your system allows for hot-swapping to avoid powering down the sound meter. Alternatively, can the system power-up on its own or is there the need for a procedure to be observed to save embarrassment later?

A couple of final points – batteries can perform very differently in cold conditions, so in winter, you should double check what to expect from your kit. There is also a safety consideration with lithium batteries and although they are not dangerous per se, you may find it very difficult to ship them, especially over-seas, but even in the UK this can be tricky and expensive with special paperwork and labelling a requirement too. Also, you are far more likely to source lead-acid batteries overseas yourself, if required.

External power

It is definitely frowned upon to hook your sound meter into the power supply for a lamp-post and it is also not a very safe thing to try, so please leave that one.

External power is always the safest option for long-term or permanent monitoring stations, providing it is technically and logistically possible to do. Power outages do still happen so should be taken into account. In this case, you should consider two things:

- Firstly, does it matter if the power is out for a while? It may be that the measurements lost are not critical; and
- Secondly, you need to be sure the system will automatically start up measuring again once the power is restored. In this situation, you can usually set a trigger to send a message if there is no signal from the equipment.

So, to be double protected, the best solution is to have a lead-acid battery as part of the system that charges from the mains power and then acts as an uninterruptable power supply (UPS) in the case of a power outage. Normally, these only last for a few hours at most, so the battery does not normally need to be very large. P30 ▶



Lithium battery (left) and lead-acid (right)



Lead-acid powered sound meter system with 3G and GPS

Solar

With the absence of mains power and the requirement for long periods of measurement, the sun, or at least its light, becomes an attractive option. Of course, we then must consider the Great British weather on top of the potential hours of daylight.

Solar panel technology is improving with new compounds being developed to increase the output relative to sunlight or daylight.

There are seven types of solar panels available:

1. Monocrystalline (Mono-SI),
 2. Polycrystalline (Poly-SI),
 3. Thin-film (TFSC),
 4. Amorphous Silicon (A-Si),
 5. Biohybrid,
 6. Cadmium Telluride (CdTe) and
 7. Concentrated PV (CVP and HCVP).
- (Fascinating stuff for a bit of side reading!)

The main panels you will find on the market for portable applications are the monocrystalline, polycrystalline and thin film types. The best of these for powering our sound meters currently are the monocrystalline panels, which are more expensive but have the best efficiency for a portable device.

We have carried out quite a lot of testing over varying weather conditions and even in rather dull, Scarborough conditions, the battery voltage rarely dipped below 13V with

a 60-Watt polycrystalline panel powering a sound meter in an environmental monitoring case.


Finally, just make sure your solar panels are not too close to the microphone as they can provide a nice reflection from the source of interest and influence your results.

Combination systems

To cover yourself for all eventualities, and if budgets and logistics allow, it is conceivably possible to combine mains power, a backup battery and solar top-up just in case the power is out for a while. In this case, you need to check with the manufacturer of the system as the more of this you wish to do, the more complicated the power management system becomes and as most people will not need this, something is usually left out to save on the final price-tag.

To conclude

Powering a sound meter system outdoors usually involves some choices, which will involve you knowing how you will normally use the kit. The most flexible system will probably have a lead acid battery, although this could leave you wanting if there is no external power source.

If you only ever conduct surveys lasting up to a week or two, then lithium batteries will keep things simple. Don't forget though, if you are using lithium, it may not be possible to add a solar panel later. The same goes for mains power with a backup battery. 



Solar powered 3G sound meter system with lead-acid backup battery