bebob

WHY BEBOB B-MOUNT?

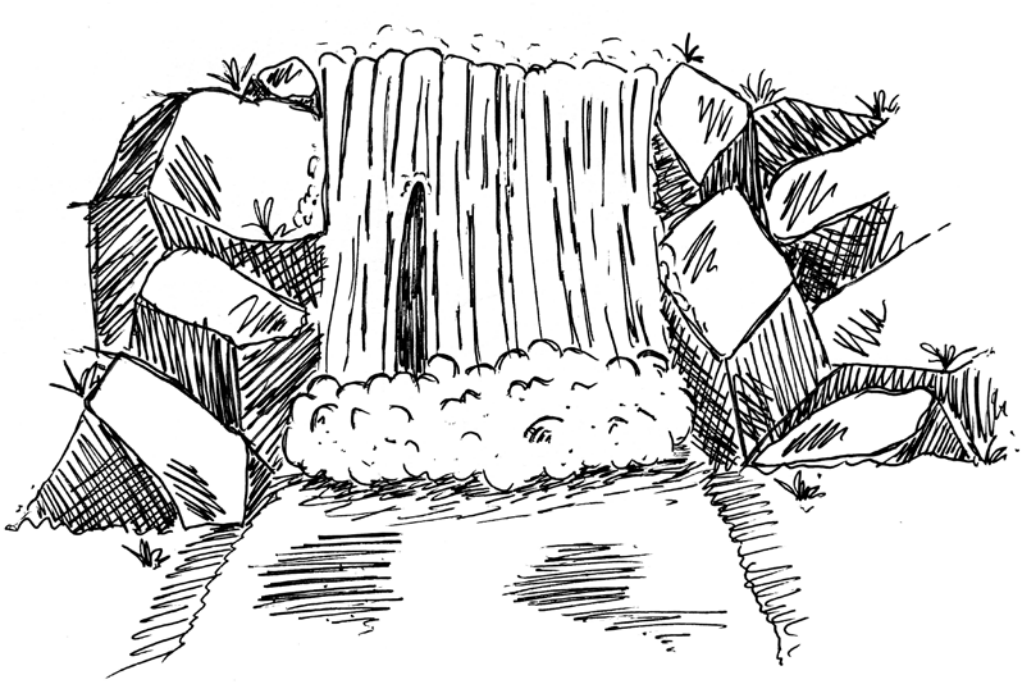
About voltage, power - and virgin olive oil

1. Technical background / Explanation of the most important terms
2. What does „native voltage" mean?
3. 28.8V versus 26V or 8s versus 7s
4. Dual voltage
5. Why B-Mount
6. Conclusion

1. TECHNICAL BACKGROUND

VOLTAGE, CURRENT AND POWER

Analogy between electric current and water:



The height of the waterfall is analogous to the voltage of the battery (volts, V).
The amount of water is analogous to its amperage (amps, A).
The water force is analogous to the power (watts, W).

The greater the height of fall and the greater the volume of water, the greater the force of the falling water.

Power (W) = Voltage (V) x Amperage (A)

The size of the reservoir is analogous to the energy or capacity (Wh or Ah).

Energy (Wh) = Voltage (V) x Capacity (Ah)

CONTINUOUS CURRENT AND PEAK CURRENT

For rechargeable batteries we differentiate between continuous current and peak current:

While the value for continuous current (in amperes, A) or power (in watts, W) indicates the amount of current that a battery can deliver continuously, peak current (in amperes, A) or peak power (in watts, W) means the current spike that the battery can deliver for a short time (a few seconds) without damage.

NOMINAL, REGULATED AND UNREGULATED VOLTAGE

There are three types of voltage:

- **Regulated voltage:** The voltage of a power source is kept at a fixed level by a voltage regulator.
- **Unregulated voltage:** The voltage of a power source is not fixed, but moves within a limited range. Batteries are generally "unregulated" because their output voltage changes depending on the state of charge and load.
- **Nominal voltage:** This refers to the operating range of an unregulated voltage source. Examples:
  - at 14.4V nominal voltage of a battery, the actual range in which the unregulated voltage moves is 10.0V (empty) to 16.8V (full).
  - at 25.2V nominal voltage of a battery, the actual range in which the unregulated voltage moves is 17.5V (empty) to 29.4V (full).
  - at 28.8V nominal voltage of a battery, the actual range in which the unregulated voltage moves is 20.0V (empty) to 33.6V (full).

STRUCTURE OF A CELL PACK

Onboard camera batteries consist of Li-Ion cells that are assembled into a cell pack.
You can connect the cells:

- **in parallel (p)** side by side to increase the continuous current (A) and capacity (Ah)

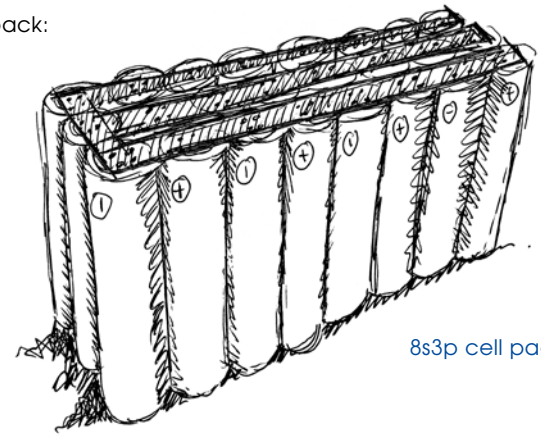
and

- **in series (s)** to increase voltage (V).

  - *A 7s1p cell pack consists of 7 cells in series.*
  - *A 4s2p cell pack consists of 8 cells, 2 parallel series of 4 cells each.*
  - *An 8s3p cell pack consists of 24 cells, 3 parallel series of 8 each.*

A single cell has a nominal voltage of 3.6V (in rare cases 3.63V).
The number of cells in series gives the nominal voltage of the pack:

- ***4s2p: 14.4V***
- ***7s1p: 25.2V****
- ***8s3p: 28.8V***



8s3p cell pack

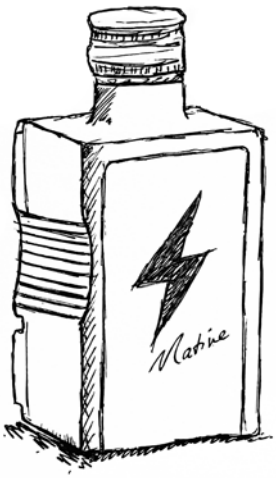
* Interestingly, 25.2V systems are generously called 26V systems by the respective manufacturers, which does not correspond to their actual voltage.

2. WHAT DOES "NATIVE VOLTAGE" MEAN?

Recently, the term "native voltage" was introduced for marketing purposes as a further distinguishing feature of rechargeable batteries – meant as a contrast to "regulated" voltage. This was accompanied by a debate as to whether "native" batteries are better than "regulated" batteries.

In any case, the term "native" sounds good and of high quality – like organic food, untreated cotton or handicraft. It suggests that "native" batteries have an advantage over "conventional" batteries – just as native (virgin) olive oils obtained by cold pressing are pure, unrefined and healthier ....

The only problem is: Compared to olive oil, for which there are also less high-quality production methods besides cold pressing, the designation "native" or "regulated" makes no sense for batteries. There are no "regulated" batteries: batteries of any kind are per se unregulated power sources – just as water is per se wet, fire is hot and olive oil is oily.
This applies to our competitors` batteries, to ours, to all batteries.



When it comes to batteries, the term "native" is completely meaningless and therefore not suitable as a distinguishing feature.

3. 28.8V VERSUS 25.2V OR 8S VERSUS 7S

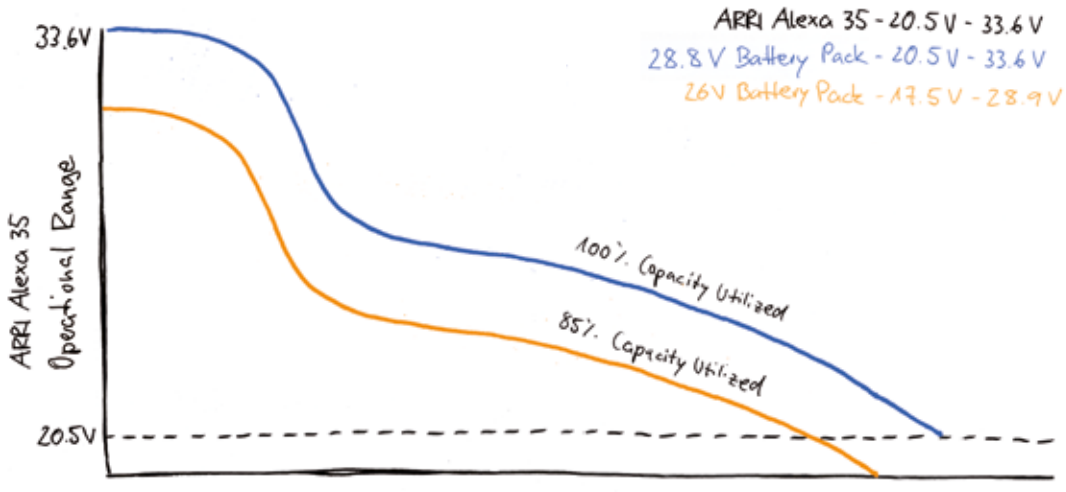
The bogus debate about „native" was probably intended to distract from a much more crucial question, namely the nominal voltage of the battery. But does it make a difference at all whether a battery has a nominal voltage of 28.8V or 25.2V?

Yes, it does.
There are three main reasons in favour of 28.8V and 8s rather than 25.2V (26V) and 7s batteries:

- **Performance:**
  The purpose of high performance batteries is to deliver higher power. This is directly dependent on the voltage:
  Power (W) = Voltage (V) x Amperage (A).
  If the voltage is higher, as in our comparison by almost 15%, the power (at the same amperage) is also 15% higher.

- **Capacity:**
  When a battery contains less cells, it also has less capacity.
  A 7s3p pack battery consists of 21 cells (7 times 3). An 8s3p consists of 24 cells (8 times 3).

- **Full capacity utilisation:**
  The working range of 8s batteries is 20V to 33.6V. This corresponds to the input voltages of current high-performance cameras (for example 20.5V and 33.6V for the new ARRI Alexa 35). The capacity of 8s batteries is fully utilised, whereas with 7s batteries the camera switches off before the battery is completely discharged (only at 17.5 V).



7s systems (so-called 26V batteries) do not have any advantages for the user, rather they provide less power and capacity than 8s systems (28.8V batteries).

4. DUAL VOLTAGE

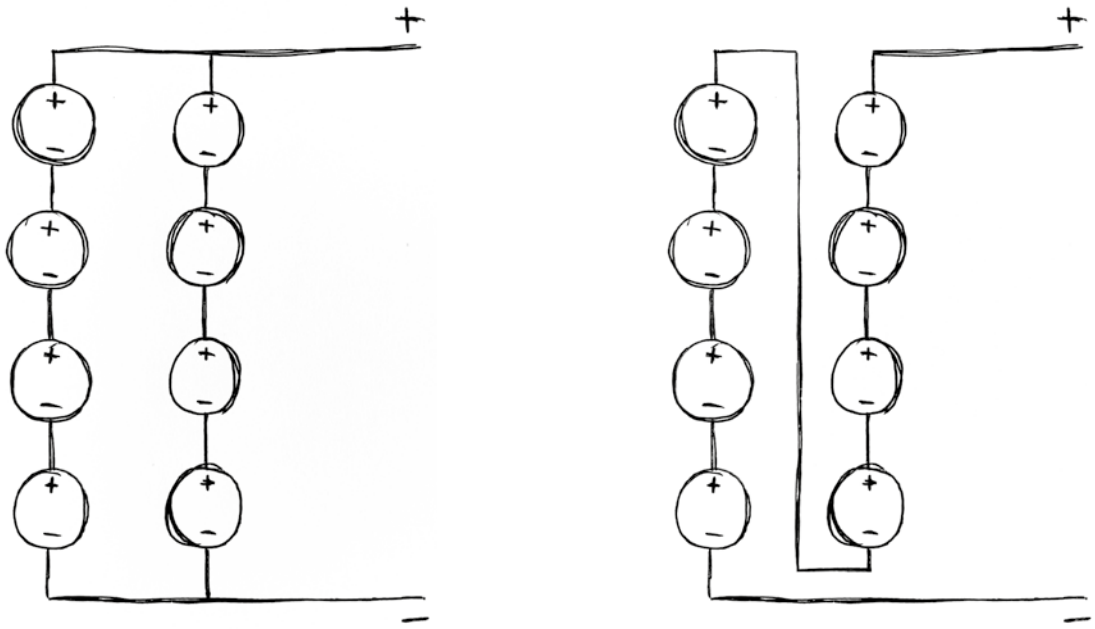
With the introduction of the Alexa 35, batteries that operate in the 20.5V to 33.6V range become necessary on set. However, many other devices still operate in the 10.0V to 16.8V range.
So either two battery systems coexist on set (incl. the corresponding adapters, chargers, etc.), or a dual voltage system is used.

How does dual voltage work?
Dual voltage batteries have a dynamic circuit. The cells are automatically connected together as needed. Either…

- **… to a 4s (4 cells in series) pack with 14.4V nominal voltage**

or

- **… to an 8s (8 cells in series) pack with 28.8V nominal voltage.**



You get two different batteries in one, so to speak. (By the way, both with "native" voltage, if you want to use the term. Not just cold-pressed olive oil, but cold-pressed olive oil in organic quality).

A dual voltage circuit is only possible with 8s batteries, as a string of 7 cells cannot be divided into two equal strings.

5. WHY B-MOUNT?

All these arguments so far would not yet necessitate a new interface such as B-Mount – so why not simply build dual voltage 14.4V/28.8V batteries for the established Gold-Mount or V-Mount interfaces?

The reason is simple: V-Mount or Gold-Mount battery systems allow a maximum output of 8 to 13.5A, because of the condition of the contact pins.

To remain within the analogy of water current: The higher the amperage, the larger the current transport logistics must be (= the diameter of the water pipes). The previous battery interfaces V-Mount and Gold-Mount have reached the end of their capabilities with 13.5A. The first generation of digital cameras with high power consumption (RED One, ARRI Alexa, ...) have led to melted contact pins and camera failures already.

The B-Mount interface and its contact pins are dimensioned for continuous currents of up to 20A as well as a continuous output of 450W – and are therefore superior to previous systems.

6. CONCLUSION: 450W – IT'S ALL ABOUT POWER, BABY!

The previous arguments prove that 28.8V and 8s batteries are **superior** to 26V and 7s concepts **in terms of performance**. Dual voltage not only **makes life on set easier**, but also **reduces costs and eliminates possible errors**. With B-Mount, there is also an interface that **expands the limits of previous interfaces**.

High-performance batteries were developed to have more power and capacity available. So why not exploit the technical possibilities of the system as much as possible?

bebob B-Mount batteries are currently the **only ones that deliver 20A continuous current**, both under 14.4V and under 28.8V nominal voltage. For several minutes, the current may even reach 23A. If we take the working range of the ARRI Alexa 35 as an example (20.5V to 33.6V), this means that a bebob B-Mount battery always provides at least 450W of power for the entire equipment.

As the inventor of the B-Mount interface, bebob has realised all the possibilities of the system in its batteries – without challenging the usual quality and typical bebob features that have proven themselves over many years.