

JUICED BIKES: FOUR REASONS FOR STANDING VOLTAGE 52V-19.2Ahr Battery Pack

Sunday, September 6, 2020

Initial Enquiry.

The Juiced Bikes (JB) *CrossCurrentX* (CCX) ebike has a 52V-19.2Ah battery pack. The pack on my bike holds a standing – or *Guard* or *Ghost* – voltage of very close to 1V. This is measurable at the discharge port when **the pack is powered off**. It is *additive* to the State of Charge (SoC) of the pack and as measured, with the pack powered up, at the discharge port; and, **at any time, at the charge port**.

The pack's controller, via its handlebar display shows the pack's port voltage **less the Guard voltage**.

Initial concern arose when I received my bike and, as per *The Destructions* tried to fully charge the pack for the first time; when it stopped charging at 57.6V:92% approximately, *pro rata* from JB's voltage: %charge table – I wondered if I had a bad pack.

So, this saga started with my first contact on the matter with JB's service/help facility¹ on June 26, 2019. I also expressed concern that I may have had a bad pack. And, if not a bad pack, how might I charge it to a full 58.8V:100%. That first reply stated:

REASON #1:

1. Marc (Juiced Bikes)

Jun 26, 3:27 PM PDT

You can go ahead and properly dispose of the throttle. Glad the new one is treating you good!

58V is full charge but as you mentioned, there is line loss or communication loss² from the battery to the controller to the display, which can render the reading slightly inaccurate. As long as the display reads more than 56V, [83%] your good to go :) If you would like a more accurate reading to be sure, I recommend using a multimeter.

NB: I had made no mention of line loss – they did. And so, I replied as follows:

Marc or Support Desk Colleague.

Been distracted – enjoying the bike. But I'M still unclear about battery voltages.

¹ My first encounters with JB's service/help facility dealing with such as a much delayed hence damage to the packaging of my bike by *Fed-No Sot-Express*; addressing a failed JB web site logon situation; and, replacing a failed thumb throttle were all good [Kudos Marc].

² Line loss aka *Communication Loss* – kinda describes the whole sorry saga as subsequently discovered.

1. I don't buy into the "...line loss" notion of why the CCU display shows reduced volt readings; the cable is adequate and less than three feet³.
2. So, I did use a multimeter and found the following with the **CCU** display showing **53.9 V**:
 - a. The charge (input) port showed **54.7 V**; **BUT**
 - b. The discharge port (bike connector)
 - i. Battery ON: **54.8 V**,
 - ii. Battery OFF: **0.968 V**, ie almost one (1) volt when everything is powered off.
 - c. $54.7 - 0.968$ *Ghost Voltage* = 53.7 approx. equal, within the limits of this limited measurement set and time delay between measurements, to what the CCU is showing
3. **CONCLUSIONS:**
 - a. the CCU, *in cahoots* with the BMS, is giving the real world voltage of the pack.
 - b. The BMS (?) is maintaining an almost one (1) volt potential across its ports;
 - c. This is key at the Charge (In) port as it *fools the charger* into stopping to charge past real world 57.8 V as, at that voltage, the charger *sees* 58.8 V, ie, 100% for a nominal 52 V pack and stops charging the pack.
 - d. 57.8 equates to just over 92.5% V (pro rata), not 95%.

What difference does 2 to 5% make? Well (as a heavy rider and a heavy bike with lock & cable) it would be nice to get a full 95% as it is a fair proportion of the 45% range, ie, down to 47% when a noticeable and increasing degradation in assist *oomph* begins. And, on occasion, it would be nice to charge to 100% immediately before starting a long ride where range is paramount. For a 50% drop to 42.5% I get about 38 miles (with a mix of Level 2 & 3) when the fun has started to degrade noticeably.

And, with that guard (ghost) voltage I cannot ever charge to an advertised and proper 95% let alone, on occasion, a fun filled 100%? Not worth buying such as Luna Cycle 80/90/100% charger as it too will be *fooled* by the charge port presenting 57.8 V when the pack is at 56.8 V odd?!?

What say you?

Regards;

Marc (Juiced Bikes)

Aug 30, 10:47 AM PDT

Going over your previous email. 58.8 typically equates to 100%. I would like to mention that discrepancies occur among batteries and not all will reach that top voltage. Going by this, 57.8 should equal to about 98%. The difference in 2% to 5% is very minimal. As long as your above 56V, you're good :)⁴

My response: Aug 30, 1:11 PM PDT

Marc;

³ Please note that, subsequently, I ascertained that the digital (?) feed length is irrelevant and that from the pack (BMS) to the controller is less than 12" – line loss, indeed.

⁴ 56.3V \equiv 85% doesn't sound so good especially for \$1,300 item, does it?

Firstly, 57.8V does not equal 98%; it equates to **93.8%** (per the table on JB's web site 57.1 V = 90%; 58.0 V = 95%). Not an insignificant shortfall.

Secondly, please address the issue of the *ghost* or *guard voltage* of almost 1 Volt that presents at the discharge port when the battery is **OFF** and is additional when the battery is **ON** and at the recharge (in) port thereby causing the charger to stop charging too early?

REASON #2:

JB's reply: 09/04/19;

Rasan Aycox (Juiced Bikes)

Sep 4, 2:32 PM PDT

Hi there,

Per our e-tech:

"its 1.5 volts loss in the system when the battery is fully charged so will never see a a battery read 58.8"

Let us know if you have any further questions.

Rasan Aycox

Customer Support Manager

Juiced Bikes www.juicedbikes.com

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I then replied expressing my dismay that JB's staff would not answer my question about the *Guard* voltage:

Sep 5, 7:51 AM PDT

Hullo Rasan;

I'm somewhat bemused that you will not answer my direct questions, directly?
Specifically:

1. Why is there an almost 1V potential across the battery's output port (feed to the bike) when it is powered off?

2. Why is that 1V *Ghost Potential* additive to:
 1. The battery's output to the bike, when the battery is powered on? And,
 2. At all times, whether the battery is powered on or off, at the charge (input) port, ie, why is the charger presented with the battery's actual voltage **PLUS 1V Ghost Voltage** so that it cannot charge above (in my case) 57.8 V being just over 93% per tables on JB's web site?
 3. How does the Controller Unit *know* that there is +1V and thereby display the correct voltage and as measured by multimeter less the 1V Ghost Voltage? That is the measured voltage at the battery **minus** the Ghost Voltage is exactly what the controller's display unit shows? How? Why?⁵
-

Another JB manager replied repeating the same rubbish about voltage drop via cable distance (resistance); the only *resistance* I was seeing was JB's refusal to answer my question.

REASON #2 v2:

Steve (Juiced Bikes)

Sep 11, 11:00 AM PDT

Our BMS has a threshold of 40 volts on all 52 volt batteries. The BMS handles all internal Data and Balancing on all 84 Cells. Also, note that there is a 1.5 to 2 volts of cable loss in the cabling so the voltage on the screen will differ from what is in the batteries⁶. Hope this helps.

Thank you,
Steve Morton
Juiced Bikes
Service, Support and Repair Team Manager
www.juicedbikes.com
1.888.303.8889

I replied the same day:

Steve;

⁵ NOTE: with reference to this voltage:%SOC I also raised concerns about JB's table of speeds: Whr/mile/range etc but will address that in a separate post if required.

⁶ What utter tosh: a 2V loss on a <12" cable, BMS-Controller. Damned luck the whole plot doesn't catch fire every time it's powered on?

It helps somewhat. I don't understand what is meant by the BMS having "...a threshold of 40 volts". My guess as to what you mean is that while the pack may be at say 57.0 volts the BMS limits voltage to 40 to the controller hence the motor?

And, I don't understand how there can be a measurable let alone **2 volt loss** over just three feet of cabling; unless said cabling is seriously underspecified?

And, if the pack never reaches 58.8 (max for 14S cells) how does the BMS do any balancing?

Please answer/comment/educate me on the foregoing as you see fit. But, if nothing else, please answer the two simple questions I have now asked **three times at least and which your staff have resolutely refused to answer (so much for support?)**:

1. Why does my battery pack (alone?) show an almost **1 volt** potential – a *Ghost Voltage* – as measured by multi-meter, at the output (to bike) connector when **powered off**?
2. Aside from the technical deflections I have received, are you saying that it is just coincidence that the voltage displayed by the controller is equal to the measured voltage at the discharge port when the battery is on (and also at the charge (input) port) **minus said 1 Ghost Voltage**? (That arithmetic is spot on; so, what price line loss?)

BOTTOM LINE: Do I have a bad battery pack? If not, why the *Ghost Voltage*?

FWIW: I increasingly suspect that it just a dodge to stop the charger from exceeding 93% of max. charge. But what do I know.

Given the run-around your multiple staff have given me by ignoring (as you have done here) my supplemental questions re *power consumption vs range tests* consider them withdrawn as I couldn't cope with any more obfuscation. Please note that I was presenting those observations in good faith in a, now clearly, vain attempt to help you improve the accuracy of your customer facing documentation and hence your reputation for direct, honest – "*telling it like it is*" – and thus fair dealing.

Some six days later I received the following reply from JB:

REASON #3:

Marc (Juiced Bikes)

Sep 17, 1:33 PM PDT

Hey there!

My associate Natan has notified me about your recent phone call with him. Upon further investigation, the 1V from the discharge port while the battery is off is to provide power to the BMS as it is needed to monitor the cells. It's completely normal :)⁷

⁷ Reason – *rationale* - #3?

To the above BS I replied on 09/18/19:

Marc;

At last, a somewhat sensible (logical and reasonable) answer to my core question. I cannot say “...specious” but there are still a few, let’s call them “...unanswered anomalies”:

1. Assuming that the BMS resides in the battery pack, not on the bike (controller?) , I still don’t see why that voltage presents at the discharge port when powered off (Certainly power, thus some vestigial voltage on a bus internally to the BMS and as controlled by it); but a somewhat *leaky* design, what?
2. Notwithstanding the BMS’s need for power when quiescent it still doesn’t explain why such a voltage is additive to that at the charging port (always) and to the battery’s discharge port when the pack is powered on?
3. And, it must be a pure coincidence, must it not (?), that the BMS “add-on” voltage is exactly the difference between voltages read at the battery’s ports and that on the bike’s CU display. Ah, that must be it – just a coincidence? (So why all the BS about line losses, etc; And why so long to come up with at least this plausible answer? Most odd. It’s collusion, heck, a conspiracy between the CU & BMS I tell ye! 😊)

But thank you for dealing with this. You (and latterly Natan) are the only JB support staff that have responded and acted effectively and in a timely matter.

In respect for your professionalism and related care I will leave you to ponder further issues, other than coincidence as above, such as: given that lithium cell balancing is done at the very end of a FULL charging cycle, ie, each cell at or very close to the max of 4.2V how on earth are the cells in a JB pack possibly balanced if the charger stops charging at 92 to 95% of that necessary voltage. *It’s a mystery, guv’*”.

And, as to the no doubt marketing department’s driven BS on power/range tables I give up ever seeing anything meaningful in that regard, eg, stating real world scenarios that respect battery longevity (# charge cycles) methods by stating starting and ending voltages (pack %) per test case, rather than the implied 100% discharge (and hence destruction??) of the pack?

I no longer expect any meaningful answers to the above (summary of) my previous observations (suggestions) and questions – I present them purely for your amusement if nothing else! 😊

All the best, ol’ e-buddy!

Out;

And then ***Silence was the Stern Reply***. [and me thinking I did have a bum battery pack but JB didn’t want to handle the (then) warranty aspects given all the waffle and random and outlandish *explanations* from them]

...until, that is, I saw *bikerjohn’s* post #125 under “**Charging to 80% without a Satiator**” tab #7; specifically:

- Another consideration is to know that a "full" charge, **using the standard charger⁸ supplied with the Juiced CCX, does not charge the battery to 100% full charge**. The charger supplied tops-off the voltage to 57.7 volts (about 93% full). Any top-off under 100% helps to reduce wear on the battery and increase it's (sic) useful life -although to a less extent than an 80% top-off charge which is considered optimal.

That is, exactly what I had experienced and measured; so, I "...wasn't imaging things".

This occurred coincident to my wishing to return to ebiking after winter, COVID-19 self-isolating, etc. So, "...once more into the fray". Or, so I thought.

And, what got me moving immediately was I first had a mini-panic after reading an article on JB's web site about having left the bike stored for so long (at 60%) without any use and re-charge activity; the article opined that a discharge/recharge should occur at least once every three months. While addressing that I re-raised the issue of the inability to charge to 100% with JB again. See: <https://support.juicedbikes.com/hc/en-us/articles/360010722852-What-is-the-best-way-to-store-the-battery-when-not-in-use-for-long-periods-of-time->

At this point you might be wondering why I kept banging on about this; I had explained why in a couple of my inputs to JB's *help* system. In essence⁹:

1. I find that (with a nearly max weight ebike) power assist tends to start fading as one approaches 50% (50.4V) battery life remaining; by 45% assist is much less;
 2. That is, the "*Fun Range*" of performance is from max charge – 93% xx – to 50% at best; ie a range of 43%, especially at max. weight rating.
 3. To be able to charge to 100%, ie, +7% is a > 16% increase to the *Fun Range* not to include the greater oomph in the +90% range.
 4. 16% of a \$1,300 asset is something I would like the opportunity and means to access if I so choose.
-

PHASE II: late summer 2020.

To more accurately manage battery charging; eg, to charge to (say) an accurate 80% or a genuine 100% I asked:

Aug 11, 2020, 8:58 AM PDT

Guys;

⁸ **NB** important to note that the standard, JB-supplied charger puts out a precise, *honest* 58.8V; it is **not cleverness or other modification of the charger as claimed by JB that causes cessation of the charging process**; rather, at 57.7V actual in the pack, the charge port presents 57.7+1.0V approx. = 58.8V \equiv a spoofed *fully charged* state.

⁹ With a very heavy lock and 7' thick cable and other gear I am at or near the load limit of 275lb. But, I suggest that any measures I take are realistic as they reflect a goodly proportion of ebike riders, namely older, overweight people looking to get back into cycling for fitness and health reasons without fear of being too tired to return home!

I do have question on the voltages; in essence when the pack is powered OFF there is still a *Ghost* or floating (?) voltage of almost 1 (one) volt at the discharge (to bike) port. Why? And, it is *additive* when the pack is powered on, ie, the Controller's Display Unit shows a voltage of the total at the discharge port minus that *Ghost* voltage.

Where does this *Ghost* voltage come from? What's it for? I would appreciate your input and advice on this as:

1. When I measure at the charge or discharge (ON) ports the measurements include the *Ghost* voltage; but what is the actual voltage of the pack and cells therein? That's is:
2. Is the Control Unit display (rested), which coincidentally does not include the *Ghost voltage*, the correct pack voltage, thence divide by 14 for the cell voltage.
3. The reason I ask is that if I use a programmable charger what do I set the target voltage to for a genuine:
 1. 80% 55.4V or $55.4 + 0.9V$ *Ghost* for a target of 56.3V
 2. 100% 58.8V or 59.7V

Thank you for your continued patience in helping me understand this matter and thus being able to optimize pack longevity and full charge range as needed?

JB acknowledged

Natan (Juiced Bikes)

Aug 12, 2020, 3:35 PM PDT

thank you so much for being a Juiced Bikes supporter and for reaching out to us. We truly appreciate the feedback and I will forward your voltage question to our engineer to see if he can chime in.

Natan

Technical Support

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Aug 18, 2020, 11:41 AM PDT

Natan;

I appreciate the thought to forward my question to an engineers but it is a week since my updated email without any substantive reply – what gives? Or, should I resubmit my query as a separate support request?

I am also concerned whether your supplied charger – maxing out at 93% 57.6V odd – enables the BMS to do effective *Cell Balancing* [my limited understanding being that a pack must be charged to then held – floated/trickle charged – at maximum voltage of 58.8V so the BMS can bring each cell up to 58.8V]. That is, if the standard charger can never charge the pack to 100% how are the cells balanced, a key factor in battery pack life???

REASON #4:

Natan (Juiced Bikes)

Aug 20, 2020, 11:16 AM PDT

the reason there is a float voltage of 1 volt, is there is still power to the capacitors through the BMS circuit. and if you put a probe on the leads, for voltage check, then touch it when it is turned off the caps will discharge even less. it is just a capacitor. these are used for in-rush current and discharge when pulling power from the source. Hope this helps

Natan

Technical Support

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I paused on the *Ghost Voltage* issue to focus on *Cell Balancing* (at less than max. voltage):

Aug 21, 2020, 7:37 AM PDT

52V019.2Ahr: I now understand that the BMS and 58.8V charger limit charging to a nominal 95% (58.0V per your chart); per the CU display the most I have seen is 92.5 to 93% (57.8V); this to enhance longevity of the pack. But a critical aspect of good battery management is CELL BALANCING. Worryingly I see no reference to that on your web site. So, how and when I cell balancing achieved for my battery pack? What must I do to ensure that cell balancing occurs (say) every fifth charge?

JB replied:

Rafael (Juiced Bikes)

Aug 21, 2020, 1:44 PM PDT

Hello there,

Thanks for contacting Juiced Bikes, here is a video with battery info.

<https://support.juicedbikes.com/hc/en-us/articles/360026938792>¹⁰

If you have any other questions let me know.

Thanks, have a good one.

Rafael

Technical Support

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After I sent a reply noting that he hadn't answered my question, he replied;

Rafael (Juiced Bikes)

Aug 21, 2020, 2:59 PM PDT

Hello there,

Here is link with quick tips for charging, and it talks about charge balance.

<https://support.juicedbikes.com/hc/en-us/articles/360019972732-Quick-tips-Charging>

- **Charge Balance:** Each battery reacts differently, and there are many variables that are related to them. One of your cells might have a slightly different measurement than the rest (unbalanced), and after a couple of charges, this can cause your system to stop charging while other cells are still capable of holding more charge. Your BMS will correct itself after a couple of charges. Be sure to follow the proper charging recommendations and wait an extra half hour after your charger shows the green light.

If there's any other question please let me know.

Thanks, have a good one.

Rafael

Technical Support

Juiced Bikes www.juicedbikes.com

¹⁰ Follow the link if you will – the article does not mention cell balancing.

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Again, nothing in the article of relevance; but closed the matter after learning to ignore previous instructions to remove the charger once the green light came on and to “...wait an extra half hour...”.

So, I asked again and then received the following:

Rafael (Juiced Bikes)

Aug 21, 2020, 1:50 PM PDT

Hello,

Here is a Lin that will show you more info about he batteries.

<https://support.juicedbikes.com/hc/en-us/articles/360026938792>

If there's any other question let me know!

Thanks, have a good one.

Rafael

Technical Support

Juiced Bikes www.juicedbikes.com

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I replied the same day, August 21st, pointing out that (for the third time) the linked article does not answer my question.

Chased up on:

- August 25th
- August 27th
- Represented the questions as a separate ticket on August 27th
- August 30th
- Chased up new ticket September 4th

No reply to any of the above (except the automatic acknowledgement of the last ticket entry)

Do JB have something to hide? What? Why? Especially the refusal to even discuss how to charge to 100%? Pre-emptive strike against users leaving packs at 100% and making warranty claims. Weak architecture? Older kit *press-ganged* into a pseudo 52V world that (may) exceed their (original) design limits? *Who Can Say?*

The End – kinda.