

JK JK-BD4A8S-4PC BMS qualification testing document

Version November 30, 2023

Test conditions – Offgrid Lab at 25C Humidity about 50%, 4S battery pack using 20 ea INR18650 cells at 2500mah each (used cells salvaged from EGO lawn tool)

Firmware versions:

Effective date of Version (found in Privacy and Protocol in app) – Jan 17,2023

BMS settings programmed in app: (BMS short beeps after every setting is programmed by hitting OK)

Battery Type (must do this first because this setting resets ALL cell parameters!!!) -Li-ion

Cell Count – 4

Battery Capacity - 15Ah

Balance Trigger Voltage 5mV

Calibrating Volt left at 15.59

Calibrating Cur left at 0, later programmed with 2.00A charge current.

The rest of the programmed settings (with exception of) are:

Appendix. Default parameters of "lithium iron", "ternary" and "lithium titanate".

S. No	Parameter	Ternary default	Iron lithium default	Lithium titanate default	unit
1	Cell low-voltage protection	2.9	2.6	1.8	V
2	Cell low-voltage protection recovery	3.2	3.0	2.0	V
3	Cell overcharge voltage	4.2	3.6	2.7	V
4	Cell overcharge protection recovery	4.1	3.4	2.4	V
5	Trigger balance differential voltage	0.01	0.01	0.01	V
6	Power off voltage	2.8	2.5	1.7	V
7	Charge overcurrent protection	30	30	30	S
8	Charging overcurrent protection release time	60	60	60	S
9	Discharge overcurrent protection delay	30	30	30	S
10	Discharge overcurrent protection release time	60	60	60	S
11	Short circuit protection release time	60	60	60	S
12	Charging over temperature protection	60	60	60	°C
13	Charging over temperature protection recovery	55	55	55	°C
14	Discharge over temperature protection	60	60	60	°C
15	Discharge over temperature protection recovery	55	55	55	°C
16	Charging low temperature protection	-20	-20	-20	°C
17	Charging low temperature protection recovery	-10	-10	-10	°C
18	MOS Over temperature protection	75	75	75	°C
19	MOS Over temperature protection recovery	70	70	70	°C

About Screen:



Factory specifications:

	ITEM	SPECIFICATIONS
1.	Model No.	JK-BD4A8S4PC
2.	Configuration	4S, 5S, 6S, 7S, 8S
3.	Balance Mode	Active Balance equilibrium
4.	Balance Current	0.4A
5.	Discharge Current	40A
6.	Charge Current	40A
7.	Main circuit conduction internal	1.3mΩ
8.	Peak Current	80A
9.	Maximum Discharge current	60A
10.	Other interfaces (customized)	RS485/can display interface
11.	Entry cable	Same port
12.	Over discharge Protection voltage	1.2-4.35 V adjustable
13.	Voltage acquisition	±5mV
14.	Overcharge Protection voltage	1.2-4.35 V adjustable
15.	Over charge release voltage	1.2-4.35 V adjustable
16.	Discharge Time of charging	2~ 120S as adjustable
17.	Over discharge recovery voltage	1.2-4.35 V adjustable
18.	Number of temperature	3 ↑
19.	Temperature protection	yes
20.	Short circuit protection	yes
21.	Coulomb meter	yes
22.	Bluetooth function	Support Android and IOS
23.	Weight	1 Pound
24.	Dimensions	4.6*3.2*0.8 In
25.	Data sheet	JK BMS Data Sheet
26.	JK BMS User Manual	JK-BMS-user-manual

Model covered:

JK Model JK-BD4A8S-4PC which are 400ma (programmable), 4-8S BMS and battery management boards with aluminum top and bottom and exposed sides. According to Jikong, minimum series cells in pack is 3 if lithium ion and 4 cells if Lithium iron, with an 8S cell maximum no matter which lithium chemistry. Manufacturer says the BMS can handle "It can also be used for 4s,5s,6s,7s and 8s battery configurations. Mean while this BMS supports for LiFePo4 (LFP from 2.5V to 3.7V), Lithium ion (Li-Ion from 3V to 4.2V) , Sodium Ion batteries (SIB from 1.5V to 4.0V) and finally Lithium titanate oxide (LTO from 1.5V to 2.8V)." This BMS features active balancing and bluetooth app and said to be for applications in scooters, tiny cars, solar power stations, home power storage, and base station backup. The Bluetooth function is built-in and does not require separate board or dongle. Reliability is unknown, but there are a number of users online that have multiple working applications over years of service. There are also a number of users experiencing some bugs like hot components (still operational) and buggy operation. Hardware may be a little more solid than firmware. Still the JK seems to get the highest marks for all-in-one Chinese BMS products.

Qualification testing – done before acceptance of product for resale to assure buyers that they have a well specified and tested product for their application

1. Hardware check – are all high and low power connectors well designed?

These so called "JK BMS" units are generally well built with what seems to be a BMS industry standard using snap-in JST style connectors making them very vibration resistant. Housing is not water resistant, circuit board is open to the world. Power wires are AWG 8 capable of 70 amps if used in chassis wiring. At power up the unit makes two shorts and one long beep. When BT connects there are 2 short beeps. Also at boot up, there is a note in "System Log" in 3 dot menu, recording the boot and faults that occur.

2. Wiring test. Unit was wired according to Jikong documentation in the manual that is sent with other units – note that this did NOT come with manual. The unit may or may not be shipped with generic manual.

3. Bluetooth app – is it available from Google Play or App Store for Apple? Yes both.

4. BMS wires = 150cm or 60 inches long, AWG22 measured at 27milliohms per foot.

5. NTC temperature sensing – with 2 ea 10k ohm NTC temp sensors on 16in (40cm) leads

6. Mounting points, are there adequate holes and or mounting points, and if so how many?

There are no mounting points on the JK units, so they must be mounted with double backed tape and/or tie wraps. They should be mounted on the Dkblock such that if they move a little, they will not short out any power or control circuitry. Some experimentation showed that one can use the 3mm threaded bolts to attach an ELL bracket for mounting. Keystone p/n 611k was used with satisfactory results but is not optimal.

7. What does LED(s) actually do? There are two red LEDs on the unit that apparently show power applied. The one closest to the cell sense lead connections blinks and the other LED closest to the MOSFET just glows red. **I've got a question into the OEM for clarification of their operation. The blinking LED blinks at a slow rate at power up, maybe once per second. When connected to Bluetooth app, it blinks at approx double that rate.**

8. Is there a sleep mode and what is current consumption in sleep and operating mode? TBD
Sleep mode – not sure it has one have email in to JK

Power usage at 15.75V Vbat – and remote switch connected (and it's own red LED on)

Connected but OFF – 10uA

Powered ON – Balance off – 51mA

Powered ON – Balance on – 52-80mA average (400ma balance)

CHG ON – DISCH ON – BAL off– 52mA

CHG ON – DISCH ON – BAL on - 52-80mA average (400ma balance)

9. Power up LED test and buzzer (if so equiped) test. Pass. Unit powers up with LED's both on and the buzzer works when connecting to Bluetooth and changing screens or parameters with Bluetooth. Boot beep is beep, beep, long beep. LED closest to sense connectors is blinking and second LED by MOSFETs is on steady.

10. Bluetooth connection test – function and ease of usage. Also password usage. Unit connected easily with Bluetooth after downloading app from Google Play store. Unit beeped twice when connected to BT. The startup did require the 1234 password, and then also required a second password when changing BMS settings, like battery type and so forth. This second password is 123456.

11. Battery types allowed. All lithium types according to Jikong.

12. Cell connection test, are the cell voltages shown clearly, how accurate are they. Cell voltages are clearly shown and displayed, to a 1mV resolution. Accuracy is very good, +/-2mV on cells 1-3, and cell4 was 20mV high. This is still only 0.51% inaccurate, so still really good.

13. Balance test. How well does the balance feature work, what is the balance current, and how fast does the balance function work on an unbalanced pack? This is an active balance unit,

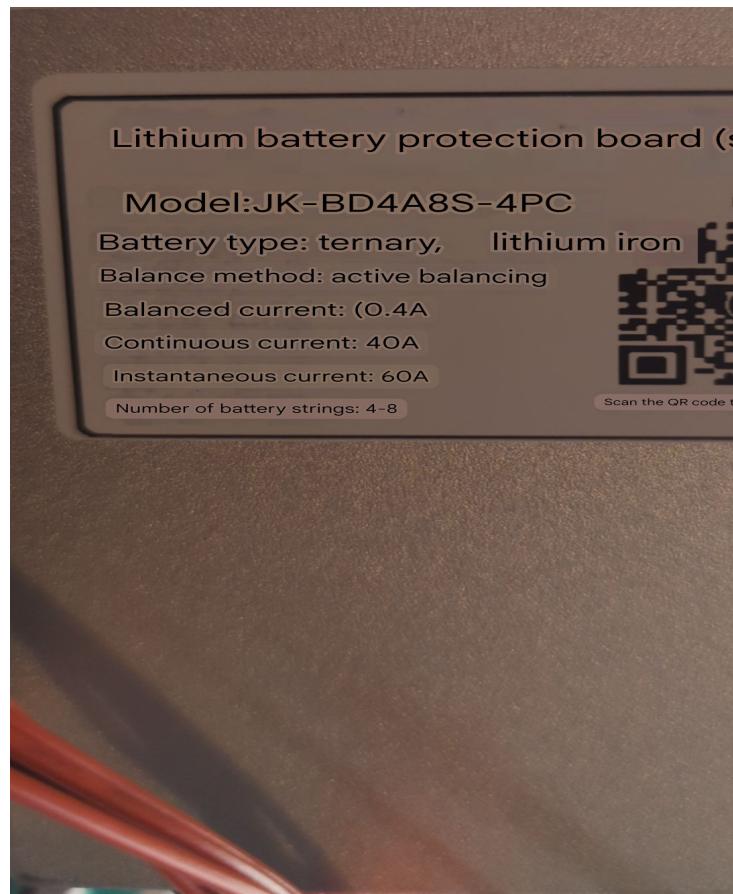
capable of being programmed from 100ma to 400ma. A VERY out of balance pack was built, with the same cell manufacturer and same cell capacities. The pack was then balanced at above 3.95V at 400ma. Started with unbalanced cells and time how long balancer takes to bring them to within 5mV of each other.

Start – 145mV delta

End – 14 hours later at 3mV of delta !!!!

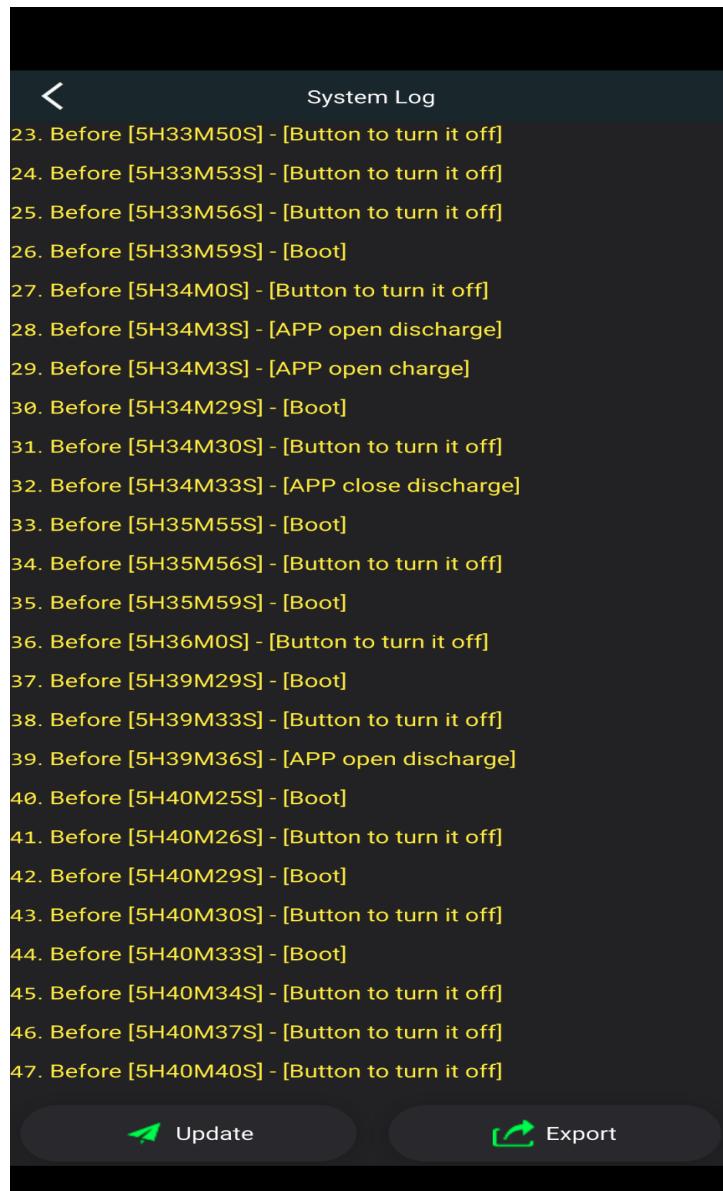
After 24 hours delta = 1mV

14. Remote meter test – what information is available, how easily is the information shown.
The remote meter shows SOC, battery voltage and charge/discharge current. It goes dark when the BMS is in idle mode (no current) and when the BMS is charging the battery, and lights up in discharge. **CONTACT JK ABOUT THIS AND SEE HOW TO KEEP it going all the time...**
15. Low voltage disconnect and reconnection function, do they work? At the design voltage?
Yes this voltage is programmable as cell and pack parameters, and this is recorded in "System Log" that is in the three dot menu in upper right of app.
16. High voltage cell disconnect and reconnection function, do they work? At the design voltage? Yes this voltage is programmable as cell and pack parameters, and this is recorded in "System Log" that is in the three dot menu in upper right of app.
17. Low and high temperature disconnect and reconnection function, do they work? At the design voltage? Yes this setting is programmable, and this is recorded in "System Log" that is in the three dot menu in upper right of app. Fluke meter reads 21C and T1 reads 20.9 and T2 reads 21.3C , so really close at ambient. Overtemp setting was 70C and reset at 60C. Fluke meter very close at those temps. Undertemp setting was 10 and reset at 15C and Fluke meter within 2C at those temps also.
18. Minimum operating voltage. Spec is 10V for 4S packs. Verified that unit works on 4S lithium ion at about 19.7V, average cell is 3.9V. Also verified that balancer works at 400ma at 4S li-ion pack. Not tested - MOSFET load and charger operation. Wake up for unit comes at **10V NOT TESTED.**



Translated with  Google Lens

19. Label on unit using Google Translate: (above)



20. APP system log (above)
21. Maximum operating voltage, spec is 8S at 4.2V = 33.6V. So take BMS to 35V in destructive test
22. How are the meters on the BMS shown, and how accurate are they. If not very accurate, how well are the calibration features designed? Meter on APP shows 15.70 and Fluke 87 reads 15.73. Calibrated current at 2.00 amps and at 10.00 amps BMS reads 10.5 amps, so 5% error at 10 amps. MOSFET is 8C above ambient at 10 amps continuous.



23. MOSFET switches ON resistance spec and measured. Specification is 1.3mohm, measured 2.2mohm at Vbat = 17V and 23C, with 10amp load, not counting lead wires, measured right at where power wires solder to board, MOSFET, plus copper PCB plus Rsense resistance. (22mv/10A)
24. MOSFET temperature at full current (according to OEM temp sensor and comparing to FLIR) for 30 minutes, dissipating $30*30*2.2\text{milliom} = 1.98\text{W} = 50\text{deg C}$ TESTED at 30 AMPS = 50C or 24C above ambient, so 30 amps should be a safe derating. See screenshot of BMS BT screens and FLIR pictures below.
25. Open MOSFET at full load and charging circuit at max current (or derated to Offgrid specs) and how much does MOSFET temperature change before and after test? 42.3C before and 42.1C after charging at 15 amps. No change at 30 amps discharge before and after load on/off test.
26. Cell wire resistance. Minimum was 320 and maximum was 417mohm on this 4S build using new cell connection board and flat cable daisychain. Believe that cell fuses are contributing 100-200milliohm to the readings.

27. Bluetooth range- open air 12 meters
28. Ham radio test – Handheld Yaesu on the _____ **BAND** radio goes OFF air when antenna is in the vicinity of the BMS
- 29. BBQ sparker test – TBD**
- 30. Output noise spectrum picture (faux FCC test) – TBD**
- 31. Destructive testing: Disconnect cell sense lead. Disconnect all sense leads. Reverse battery, 110VDC input**
32. Short circuit test – passed. Unit shut down, since power supply voltage = 0V, and unit restarts normally.
33. Reverse cell sense leads, disconnected sense leads – passed. Unit registers 0V on app, and resets properly when cells are reconnected normally.
34. SOC meter test – how to calibrate and how accurate after calibration – Steve_S on diysolarforum says "The SOC will NOT set till it has run through 2 cycles. " Offgrid test once complete charge discharge cycle per JK instructions, Battery capacity remained unchanged at 15.0ah even though last discharge was 22.8ah. After 4 cycle still at 15 ah, so much need more cycles?
35. Floating metal test – PASS, all exposed metal on case is disconnected from circuit connections, so case is floating.
36. Does unit come with manual, is it any good? Will you ship manual or just provide URL to Offgrid or OEM manual online? Jikong ships a manual with every unit, that shows detailed product specifications, how to find the app, and how to login to the app using passwords. There is a connection diagram for every series cell configuration from 7S to 24S, and there are FAQ and instructions on SOC calibration and voltage and current calibration. I found the voltage to be exact with the Fluke 87 and current to need calibration.
37. Overall impressions of unit, At day two of testing, when disconnecting B- lead and inserting Fluke current meter, unit would not stay powered on after reboot. Disconnected all leads and retried, and after a few reboots, and holding down power button for a while, unit stayed on. Repeated disconnection test and unit would not stay powered. Disconnected all sense leads and waited 10 minutes. First reboot was same power down problem. Second reboot the power stayed on and unit is operating. Repeated test a third time. Same except it stayed on after the 3rd time pressing power switch.
38. Factory support available? After 5 days no response from Jikong factory. Will try reseller that this unit came from next – srikobatteries.com – emailed on 12/1. SRIKO got back to me same day saying they were out of the office, and let's talk soon!
39. Ratings for reselling: derating current specification from optimistic factory values
 BMS load current, operating and sleep,
 Operating voltages – 4S-8S for all lithium types, so 10-35VDC
 OEM rates max continuous current at 40A charge and discharge so derate to 30A continuous charge and discharge currents.
 OEM balance current of 400ma
 OEM remote control is supported by Offgrid
 OEM RS485 and CANBUS not supported by Offgrid at this time
 I will ship the JK manual plus put a sticker on the BMS that shows where to find the Dkblock assembly and some hints on usage and manual clarifications.

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1. Product quick test pre-sale – basic on/off functionality
 - Power up LED test, and buzzer if so equipped
 - Bluetooth connection test
 - Cell voltages check accuracy
 - Balance test working yes or no
 - Remote meter test working yes or no
 - Low/high cell voltage and temperature disconnect
 - Voltage and current meter operational at nominal Vbat and 1-2 amps
3. Warranty and return policy -30 day return from Offgrid and 1 year warranty from Jikong
4. Suggested usage: For getting long and safe life from a bank of lithium cells and as a safeguard against battery failure, since BMS is cheaper than a new battery. Make sure to note that charger should have high voltage disconnect and turn off, and load controller (inverter) should have high and low battery disconnects as well. Inverter/controller and charger protection should trip before BMS MOSFETS so that BMS becomes the final line of defense to save battery if something goes wrong.
5. Final specs for Offgrid Systems Llc web
 - minimum operating voltage – 4S any type or 10VDC whichever is higher
 - Maximum voltage – 8S any type or 35V whichever is lower
 - Maximum current – 40A surge, 30A continuous
 - Min/Max operating temperature - -20C to 70C
 - Size and weight of package with/without cells – 6lbs 2oz (2.75kg) with cells or 2lbs oz (899g) without cells
 - Manual provided or URL to connection diagram and operating manual - YES
6. Contact at JK for service, application help, or OEM design: "Feel free to contact us for assembly manual or custom design BMS or if technical support is needed by email info@jkbms.com "
7. Offgrid Label on unit:
8. Contents of KIT for DKBLOCK-4S:
 - JK BMS **JK-BD4A8S-4PC (another kit model will be offered WITHOUT)**
 - **4 plastic cell holders**
 - **4 clamp boards (2 ea hicell and 2 ea lowcell)**
 - **2 connection boards (#1-2 programmed for 4S) and soldered to BMS cable**
 - **1 ea JK-BMS cable cut to 5 inches long**
 - **1 ea Flat cable**
 - **Hardware kit with all screws, 36 ea al standoffs, 72 ea 6-32 screws, 12 ea small self threading screws and 4 ea retainer clips, 1 ea DK busbar, and 2 ea DK-1/4 busbars**

9 . Online anecdotes about this model:

Capt Bill on diysolarforum says "One BMS mistake I learned from: Always make sure your BMS is totally turned off before removing or messing with the balance wires. I got a spark on my Chargery BMS from this mistake, and while it still worked got tweaked (no longer accurate;

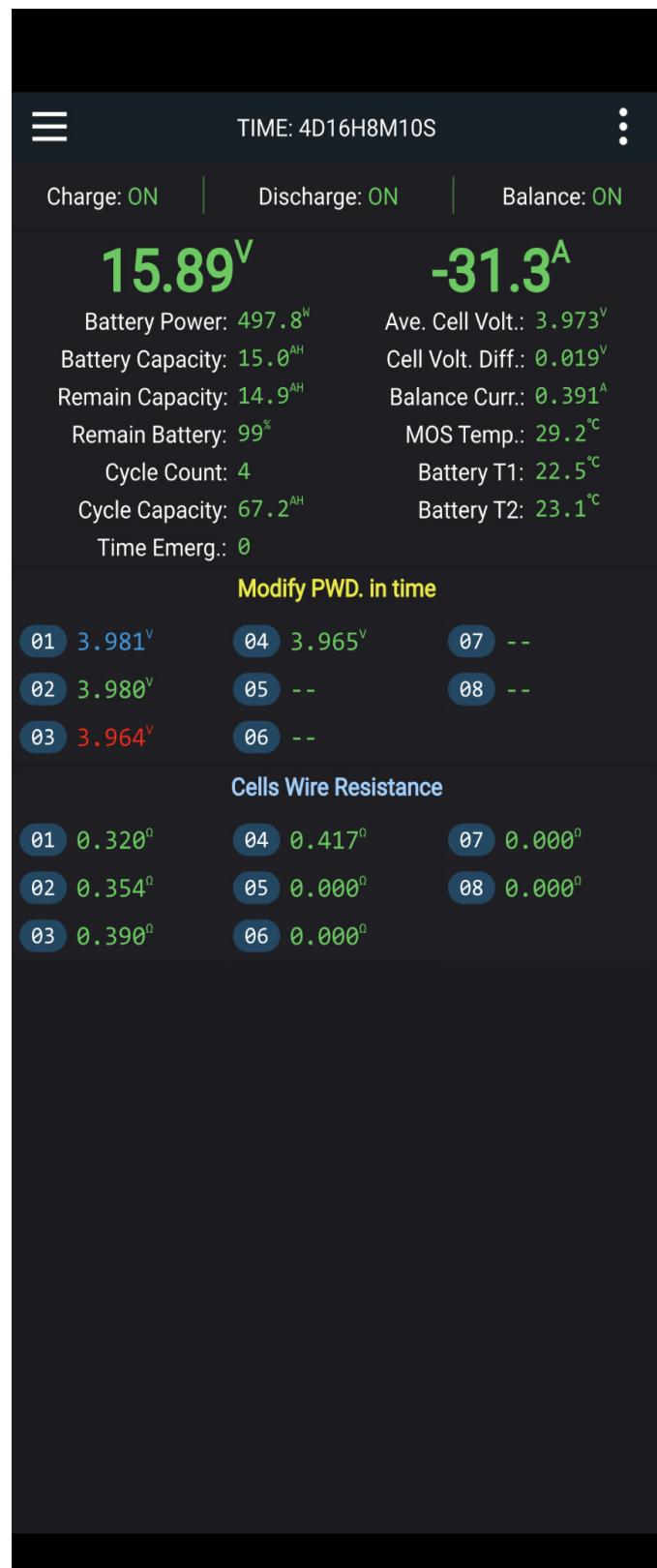
dependable) . I replaced it. Also think it smart to remove the black wire first when working with BMS cell balance and monitoring wires. ... One of My Lessons from my own mistake. " My own Offgrid take is to remove the B+ lead first. That seems to power down the BMS and then you can do any wiring changes needed.

Firmware changelog:

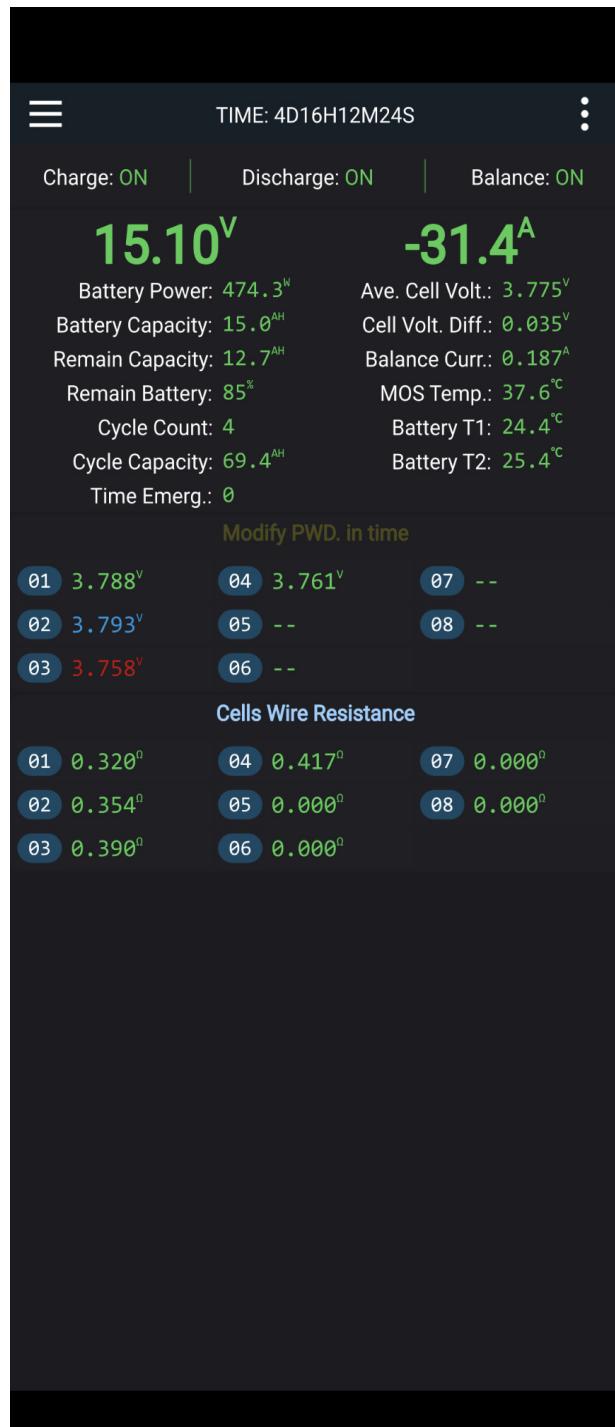
History of Version		
V4.16.4	- Change remaining battery logic - Change CAN interface protocol list	
V4.16.3	- Change parameter protocol table - Added alarm options	
V4.16.2	- Display optimization	
V4.16.1	- Platform optimization	
V4.16.0	- Function optimization	
V4.15.7	- Function optimization - Supercharged model support - Added parameter display and settings	
V4.15.6	- Change serial port, CAN protocol options	
V4.15.5	- Add model support - Change balance status display - Change pre-charge display	
V4.15.4	- Add model support - Modify serial port protocol options - Increase serial port 2 protocol selection	
V4.15.3		

30 Amp discharge test:

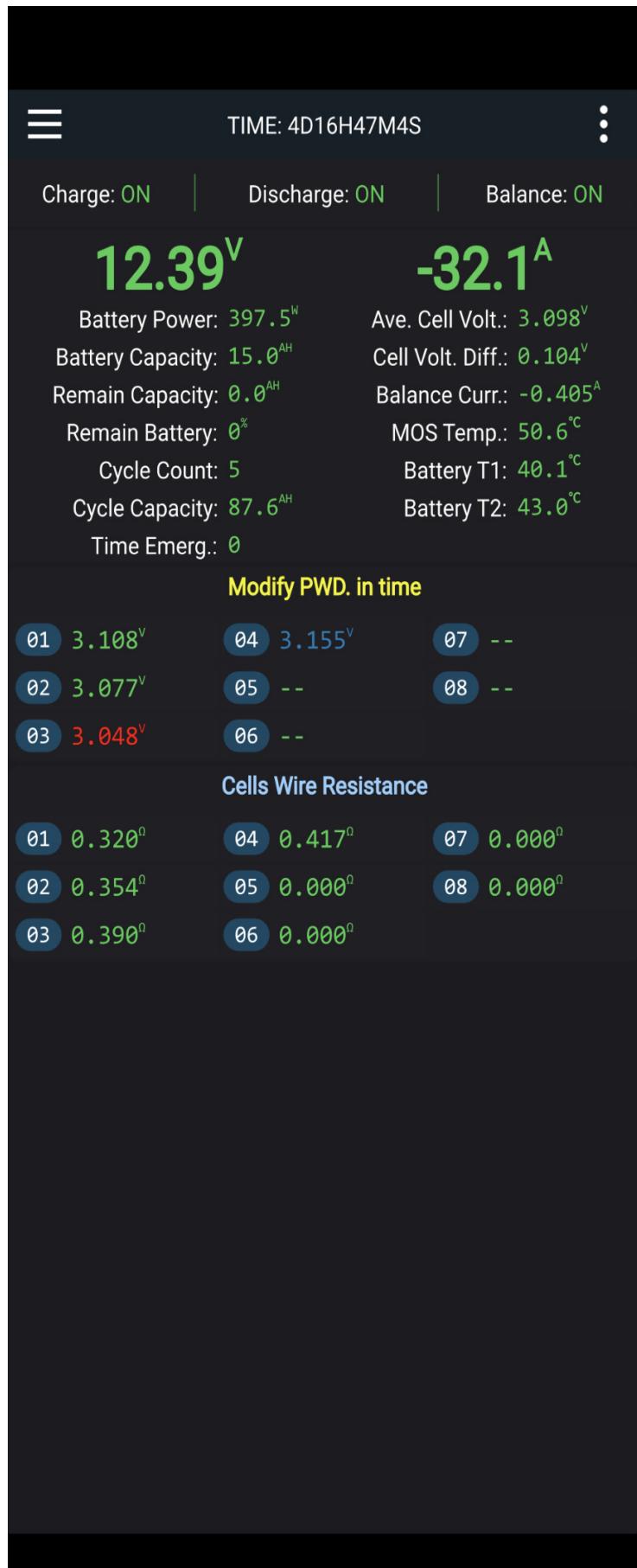
At start of test, actual current measurement = 31 amps:



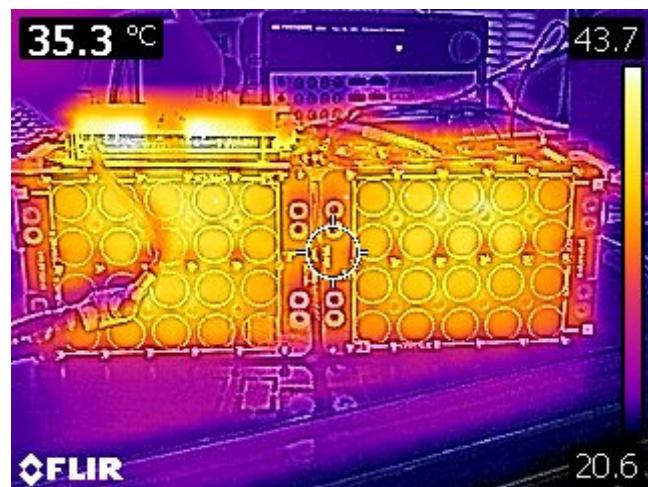
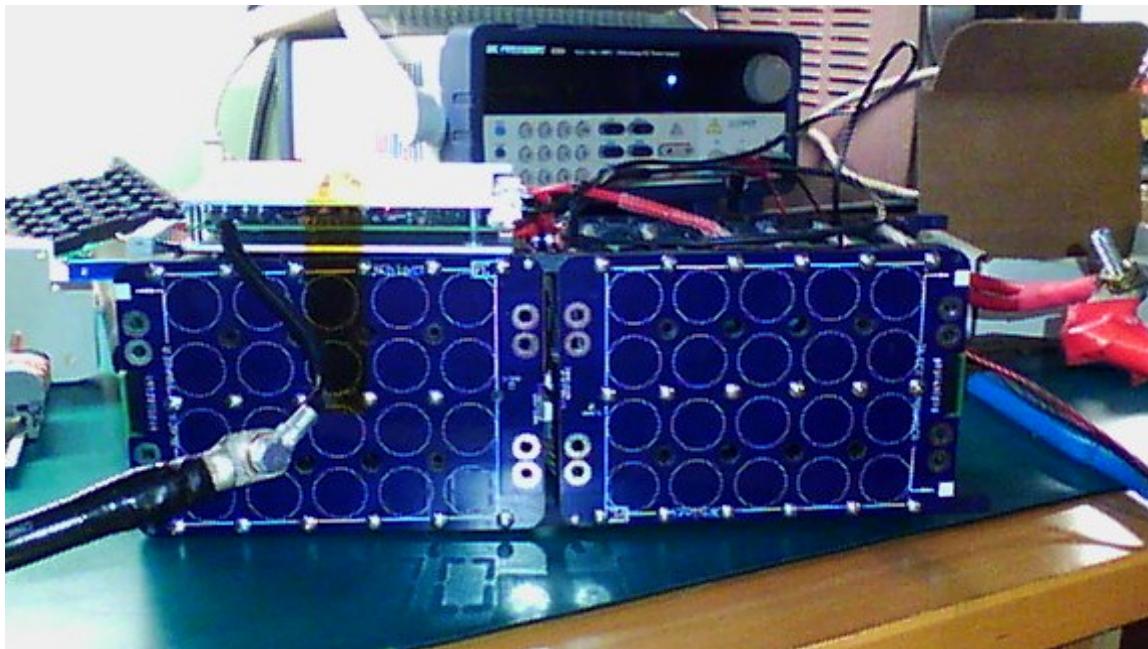
During test:

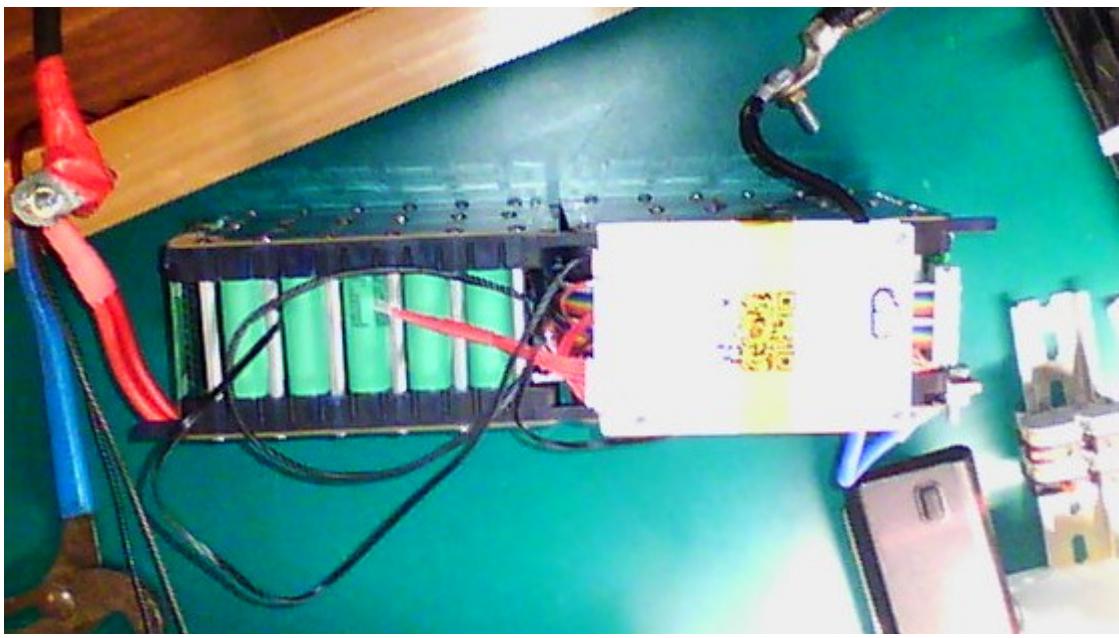


At end of test, with MOSFET's at 51C, BMS turned off current at full load after 35 minutes: (note battery temperature)

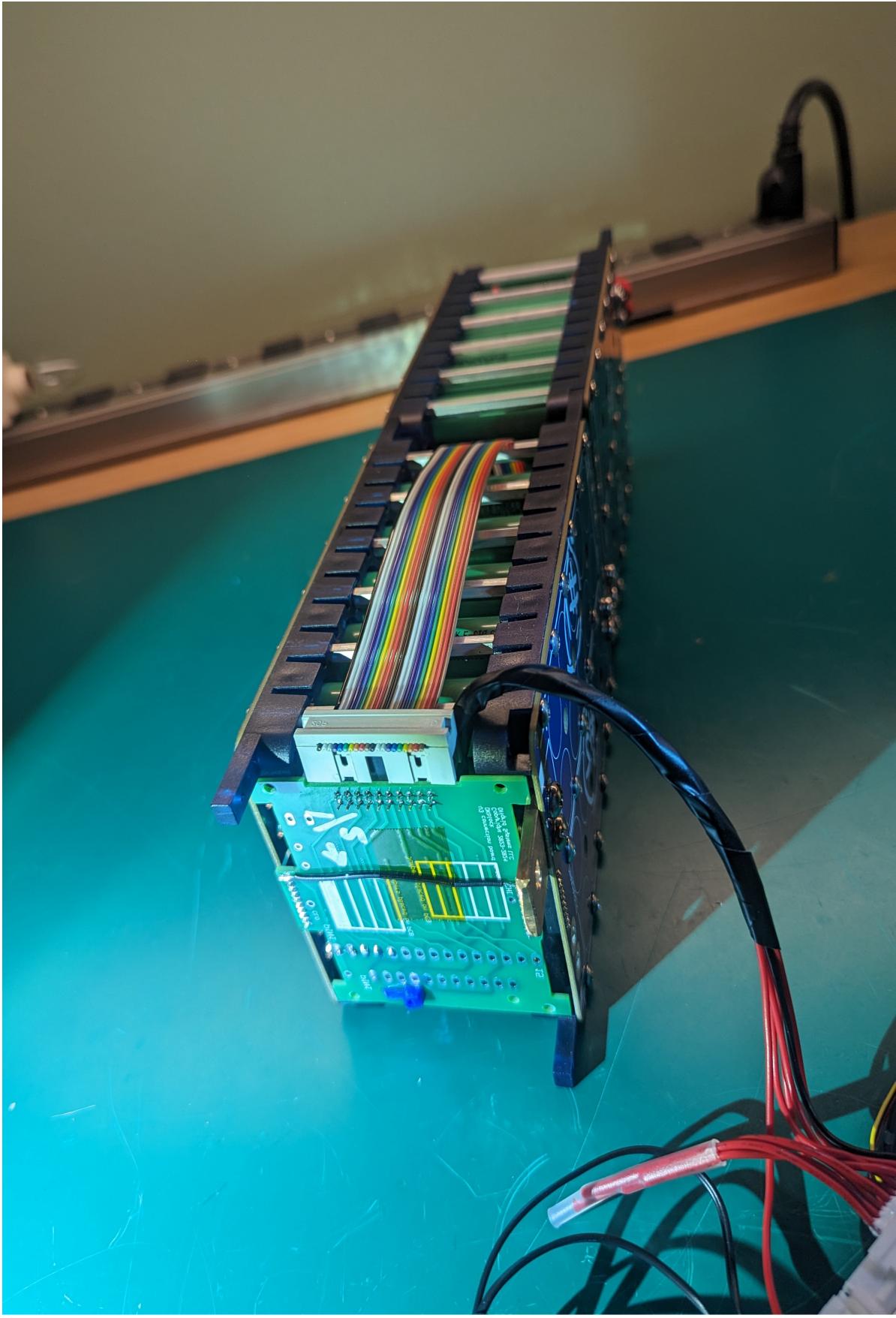


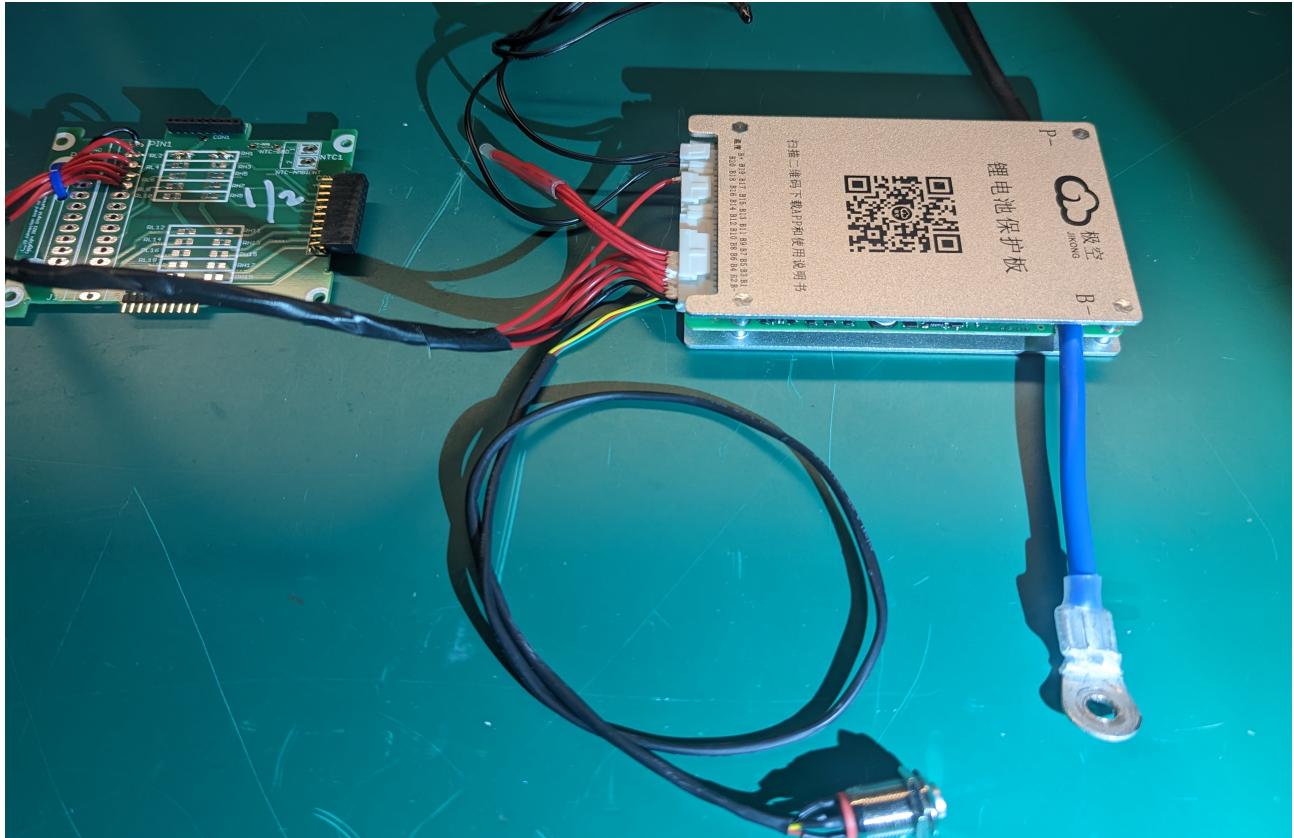
And pictures near end of test...



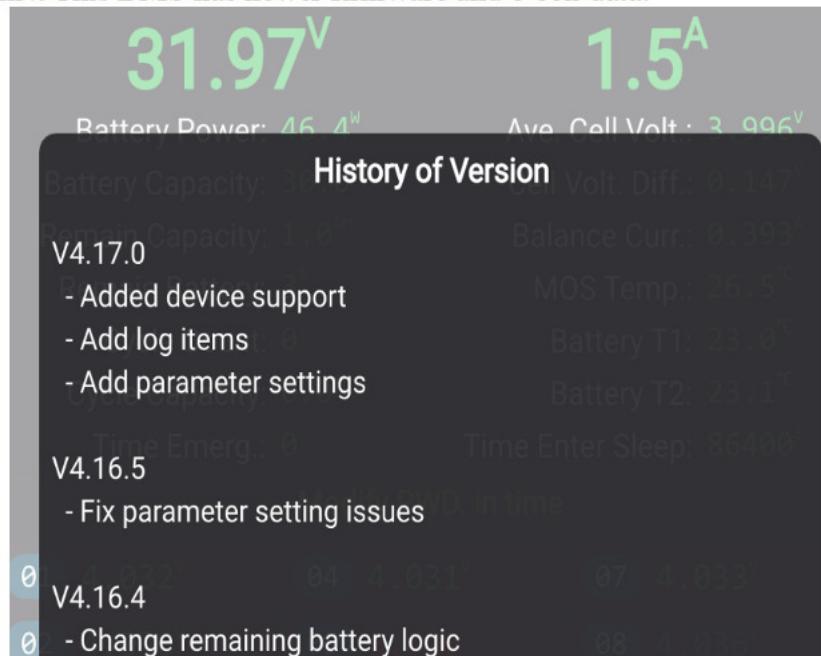


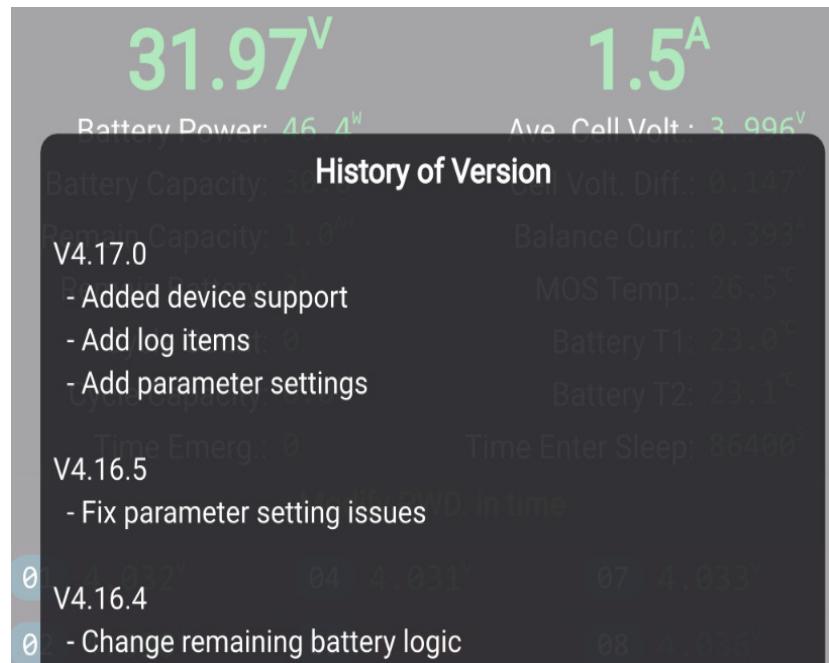
And pictures of the Unit under Test....

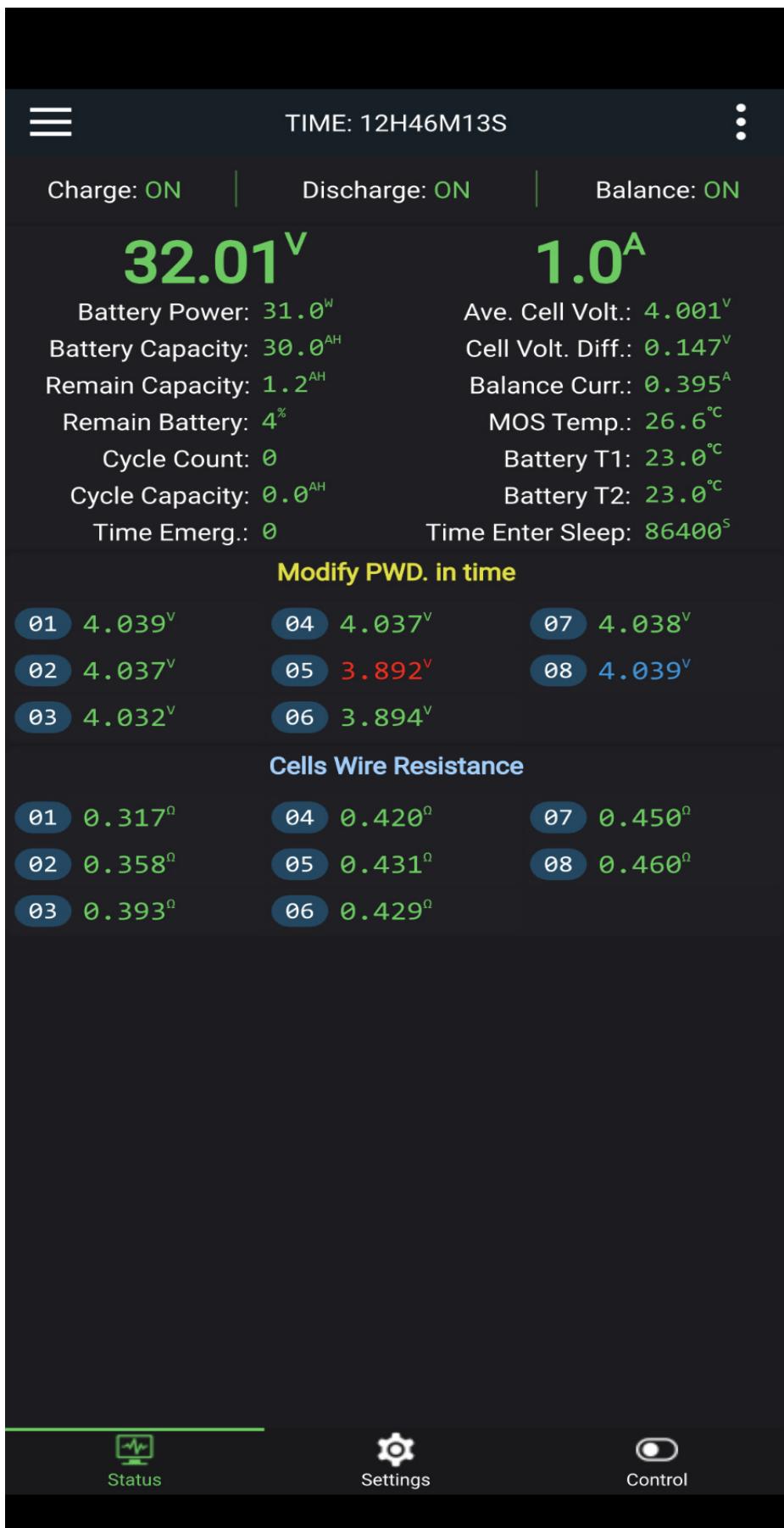




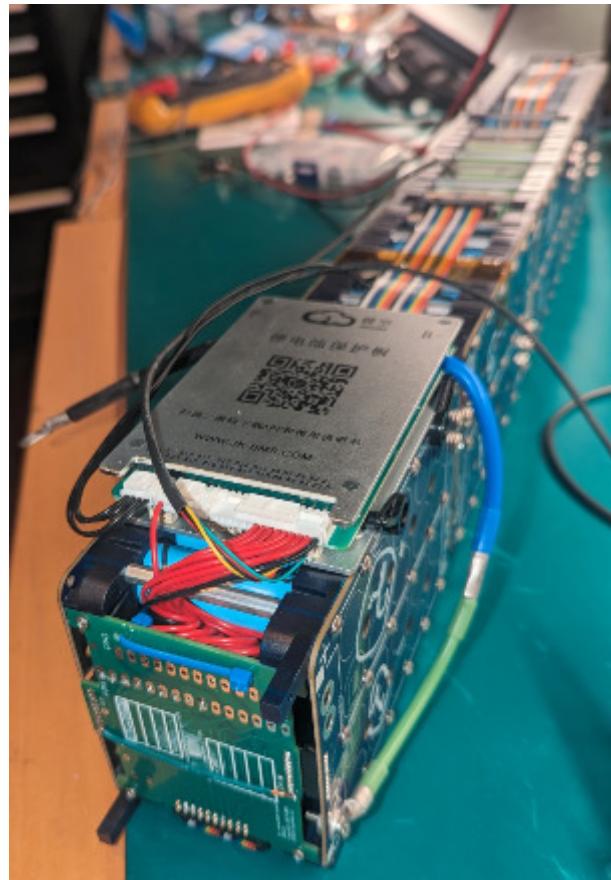
Second unit tested in an 8S configuration, I call the frankenstein pack with all different cell mfg's and cell capacities. Started out being over 300mv out of balance. Within 24 hours is within 55mv of balance, goal is 5mv. This BMS has newer firmware and 8 cell data:







This BMS is being held by the new plastic screen clips and does a pretty good job:



There is a question still about how high the cell resistance can be before the JK BMS faults on that value. My belief is that it is below 500 mohms, and we are at 450 and 460 mohms, so we will have to test that parameter.