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Warnings

⚠️ **WARNING!**

Li-Ion batteries are very dangerous! Improper use of this equipment may cause a fire.

⚠️ **WARNING!**

At least a basic knowledge of electronics and electrical engineering is required to use this equipment.

⚠️ **WARNING!**

Read and follow the user manual carefully when installing this equipment.
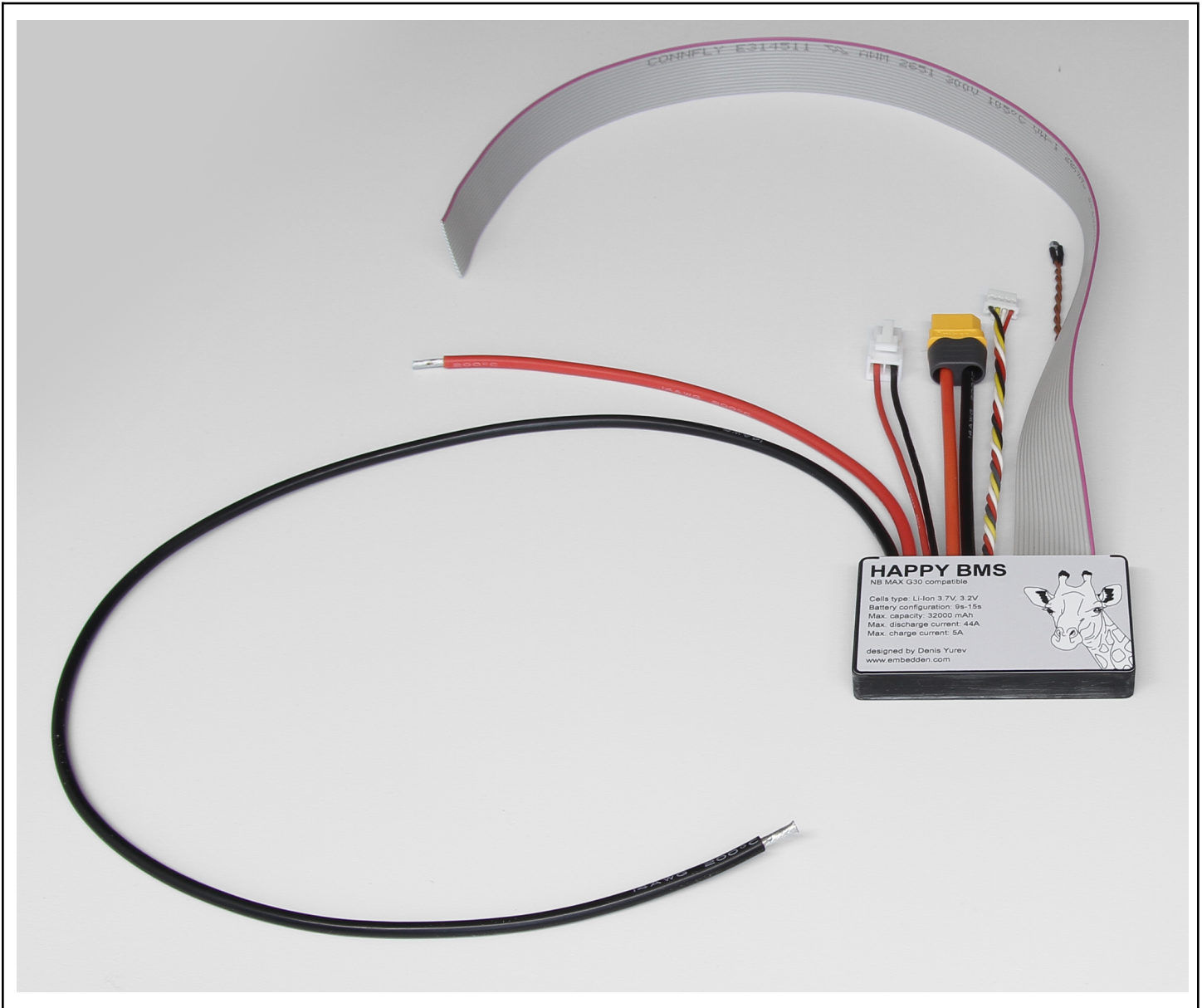
Introduction

Xiaomi and Ninebot electric scooters are of excellent quality, including the battery quality. Batteries are well assembled and high-quality branded electronics equipped. On the one hand, this affords maximum safety and usability, but on the other hand, it's not so easy to make a custom compatible battery, using common parts widely presented on the market .

Happy BMS is especially designed to be hardware and software compatible with Xiaomi and Ninebot electronics, so you can use it to easily make custom batteries. A battery equipped with Happy BMS is recognized by Xiaomi and Ninebot electric scooters as original, keeping all the functionality of the scooter.

The main Happy BMS feature is up to 15s battery support, which means you can equip your scooter with a 15s battery instead of the original 10s, reaching +50% to the maximum speed. You can also configure some parameters, such as capacity, discharge curve, serial number and maximum current, improving the performance of the scooter.
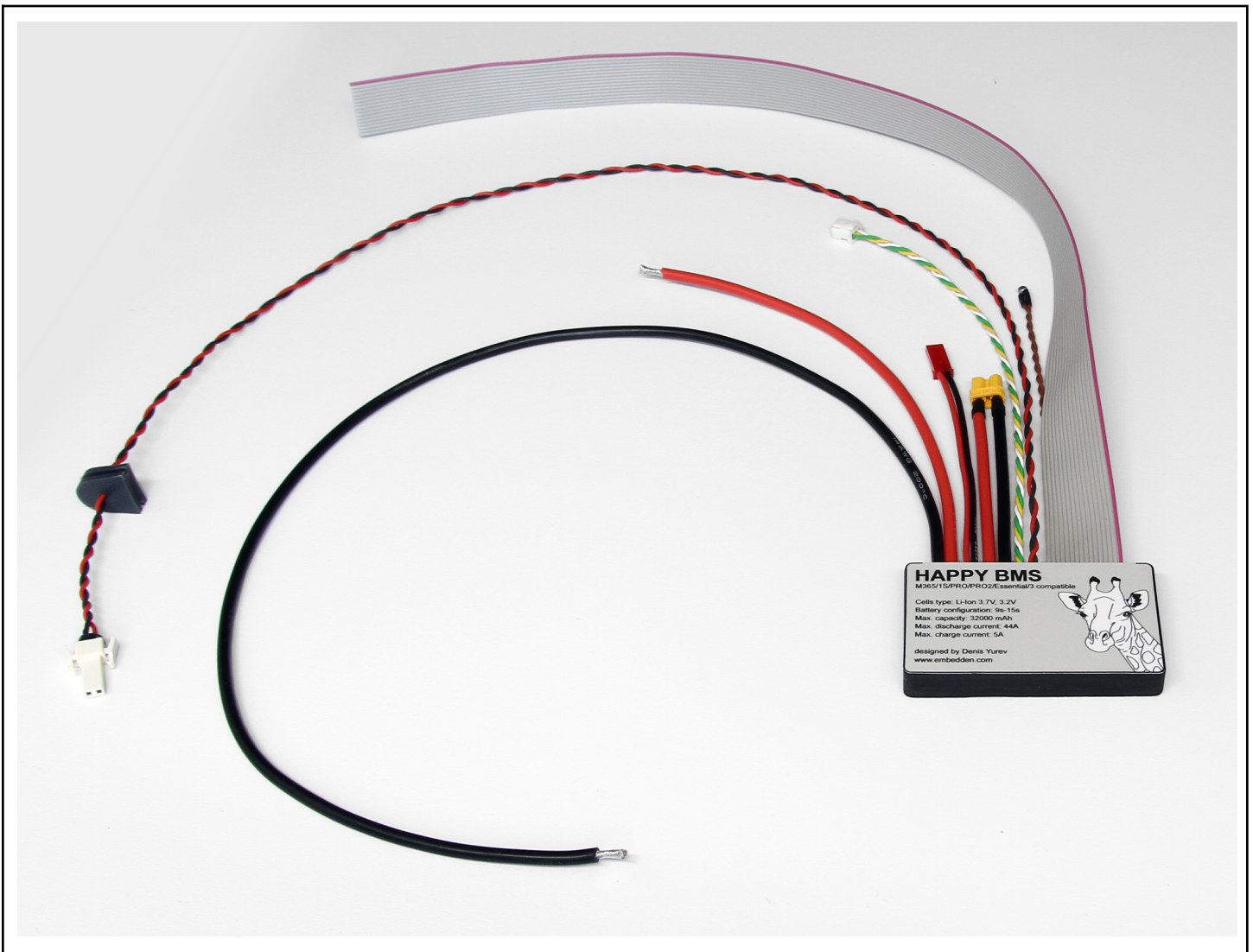
Happy BMS - Xiaomi edition

Happy BMS - Ninebot edition

Typical application
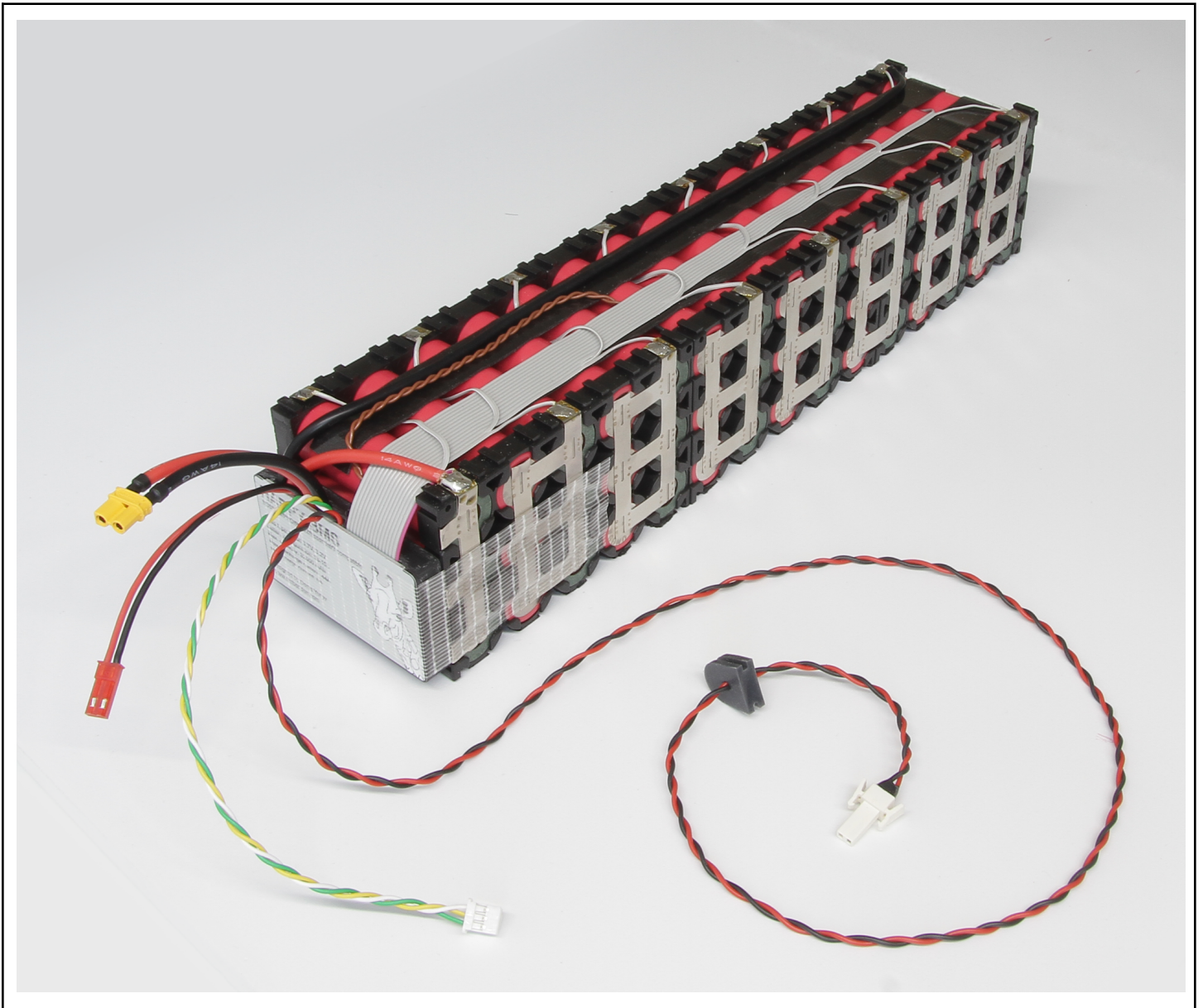
Typical application

Pinout

Xiaomi edition

Discharge output   **Data lines**

Charge input   **Tail light**

Battery positive   **Cells temperature sensor**

Battery negative   **Balancing wires**

LED

HAPPY BMS

M365/1S/PRO/PRO2/Essential/3 compatible

Cells type: Li-Ion 3.7V, 3.2V
Battery configuration: 9s-15s
Max. capacity: 32000 mAh
Max. discharge current: 44A
Max. charge current: 5A

designed by Denis Yurev
www.embedden.com
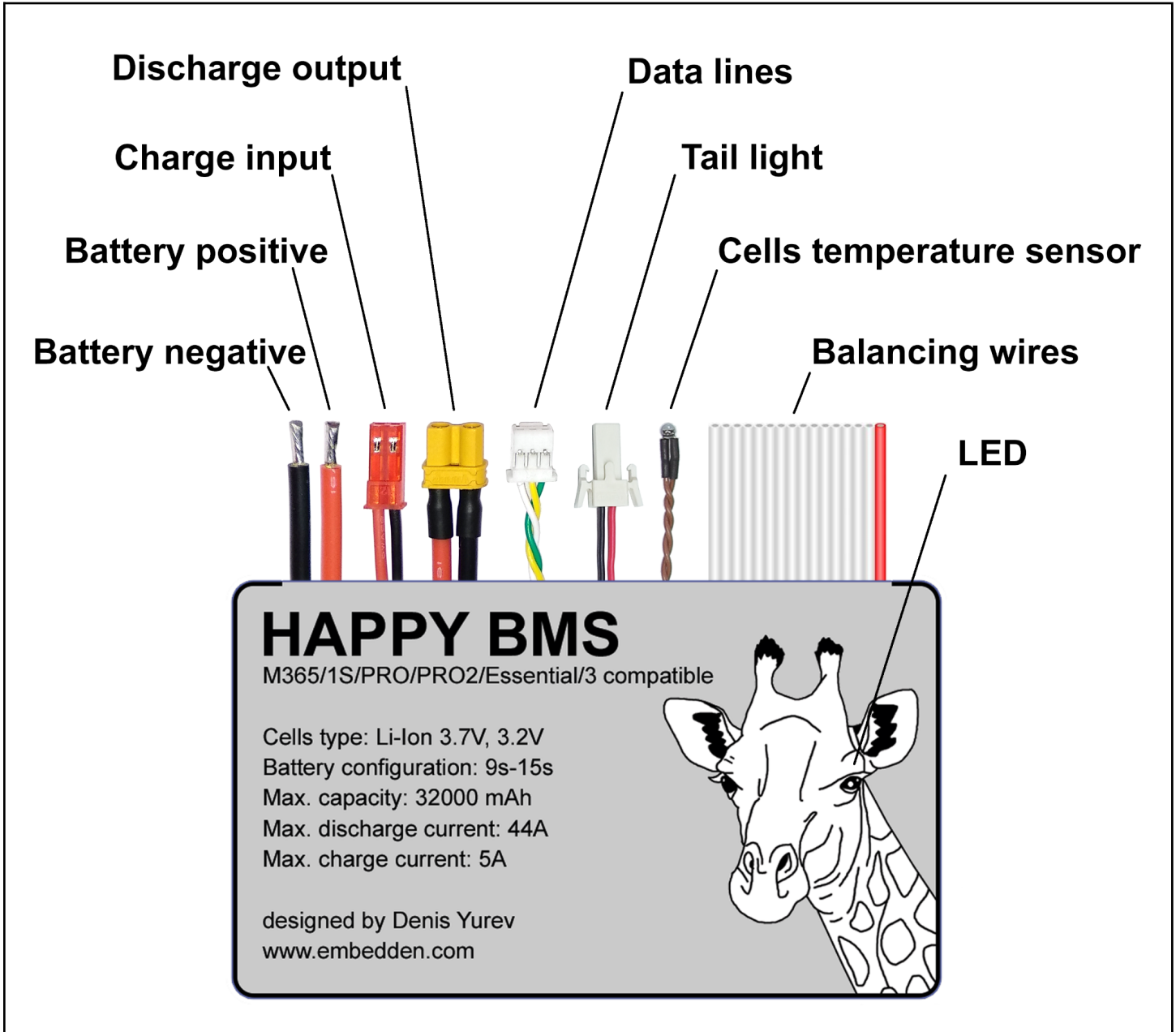
Pinout - Xiaomi edition

Ninebot edition

Discharge output

Data lines

Charge input

Battery positive

Cells temperature sensor

Battery negative

Balancing wires

LED

HAPPY BMS

NB MAX G30 compatible

Cells type: Li-Ion 3.7V, 3.2V
Battery configuration: 9s-15s
Max. capacity: 32000 mAh
Max. discharge current: 44A
Max. charge current: 5A

designed by Denis Yurev
www.embedden.com
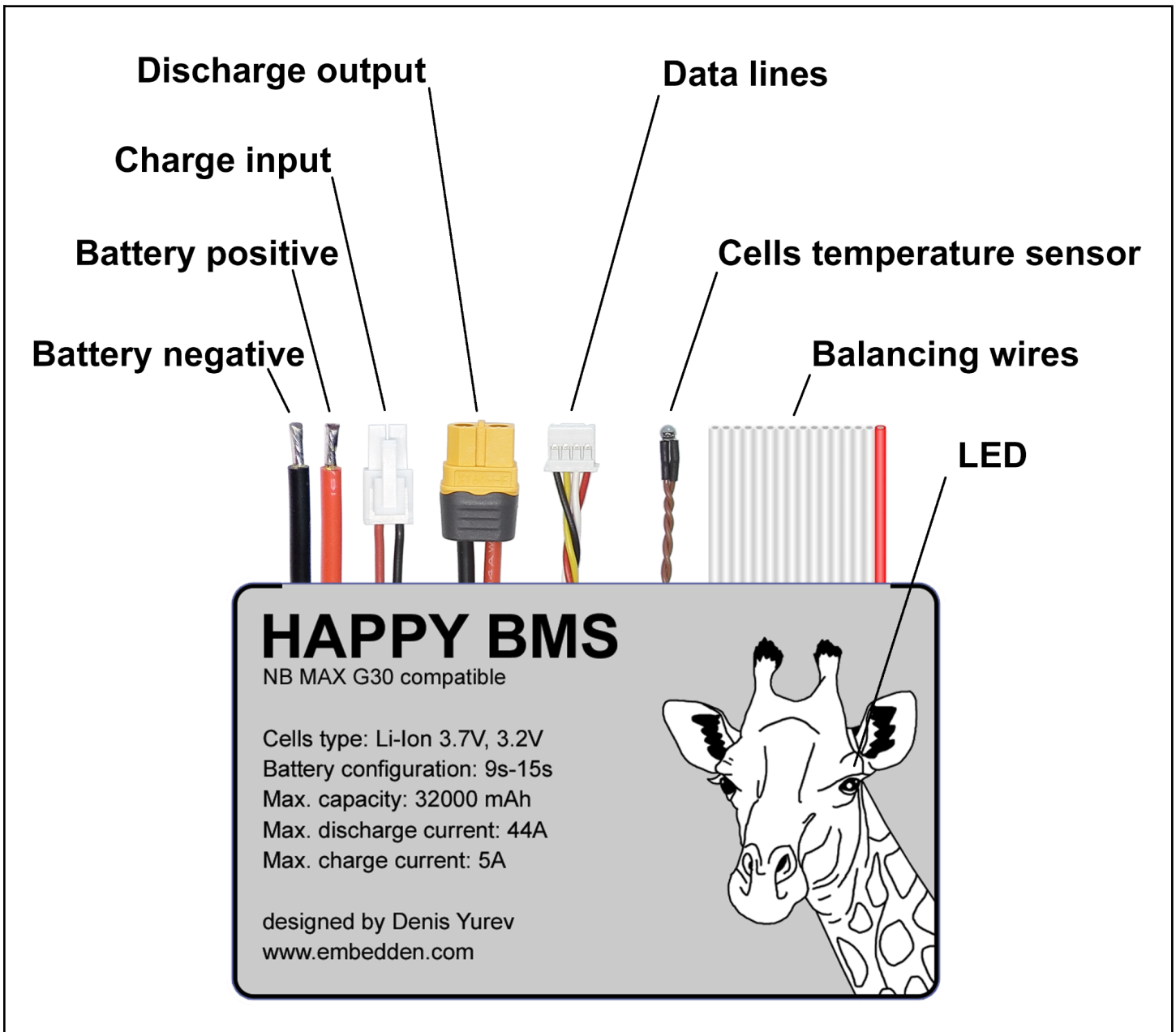
Pinout - Ninebot edition

Basic specifications

Supported battery types	Li-ion 3.7V, 3.2V
Supported battery configurations	9s-15s
Maximum battery capacity, mA*h	32000
Maximum continuous discharge current, A	44*
Maximum continuous charge current, A	5**
Effective cells balancing current, mA	25
Supported e-scooters	Xiaomi M187, M365, PRO, 1S, Essential, PRO2, 3 Ninebot MAX G30
Dimensions, mm	66x39x9

*The Xiaomi edition of the BMS requires the discharging plug reinforcement for 30A+ discharging, as the original plugs are 30A rated. The BMS and wires are strong enough for 44A discharging. The Ninebot edition is ready for 44A discharge out of the box.

**The Xiaomi edition of the BMS requires the charging plug reinforcement for 3A+ charging, as the original plugs are 3A rated. The BMS and wires are strong enough for 5A charging. The Ninebot edition is ready for 5A charging out of the box.

Wiring

The diagrams below show the Xiaomi BMS connection. But since there is no difference between the wiring inside the battery between the Xiaomi and Ninebot versions, the diagrams can be used to connect the Ninebot BMS as well.

⚠️ **WARNING!**

Follow the wiring sequence to avoid the BMS damage. Each connection is labeled with a number. Connect #1 wire first, then connect #2, #3, etc. If multiple wires are labeled with the same number, connect the wires to each other first, and then connect the joint to the battery.

15s

Follow the wiring sequence to avoid the BMS damage

Each connection is labeled with a number. Connect the wire #1 first, then connect #2, #3, etc. If multiple wires are labeled with the same number, connect the wires to each other first, and then connect the joint to the battery.

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14s

**Follow the wiring sequence
to avoid the BMS damage**

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Connect the wire #1 first, then connect #2, #3, etc.
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number, connect the wires to each other first,
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HAPPY BMS
M365/1S/PRO/PRO2/Essential/3 compatible

Cells type: Li-Ion 3.7V, 3.2V
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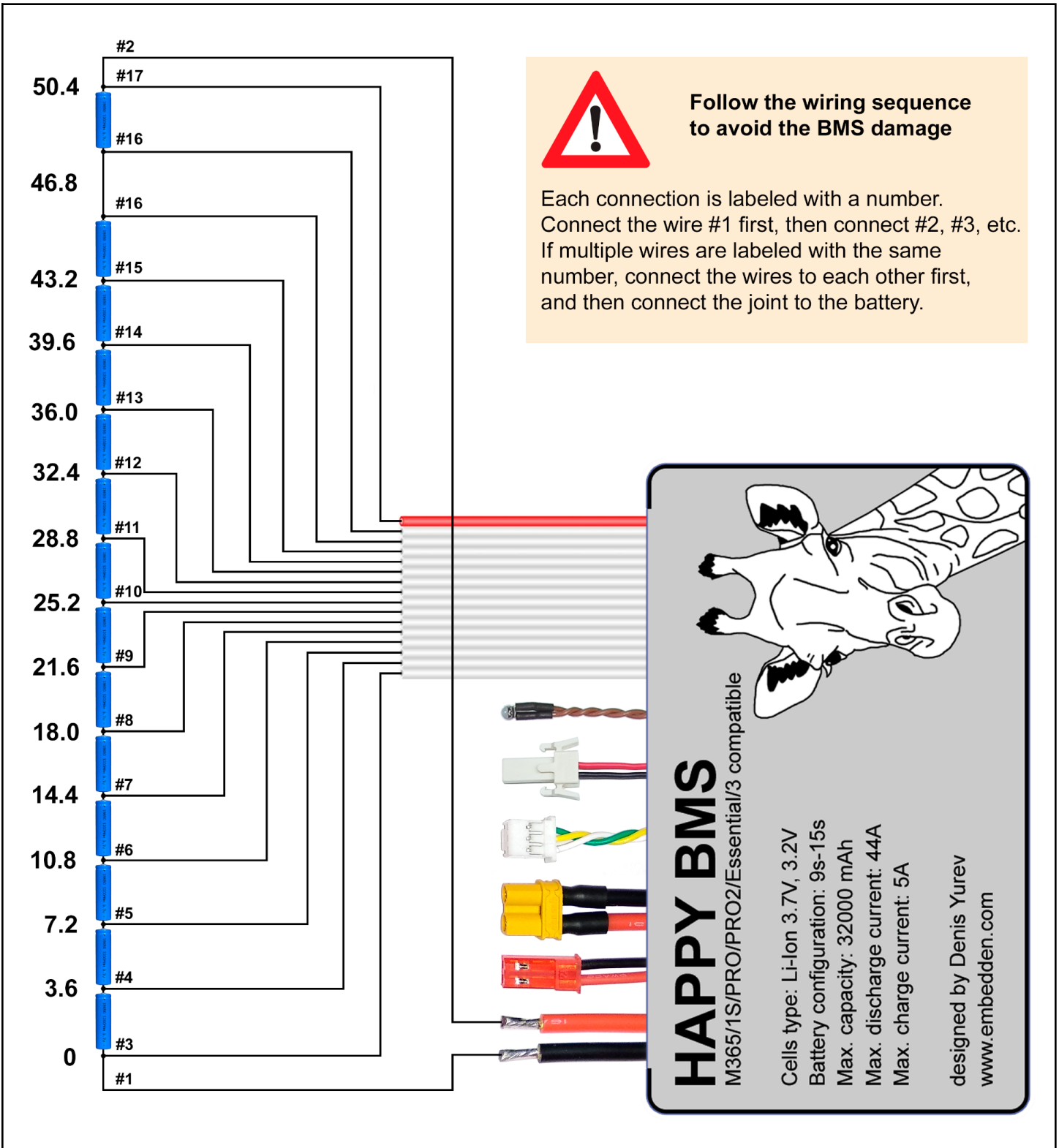
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13s

Follow the wiring sequence to avoid the BMS damage

Each connection is labeled with a number. Connect the wire #1 first, then connect #2, #3, etc. If multiple wires are labeled with the same number, connect the wires to each other first, and then connect the joint to the battery.
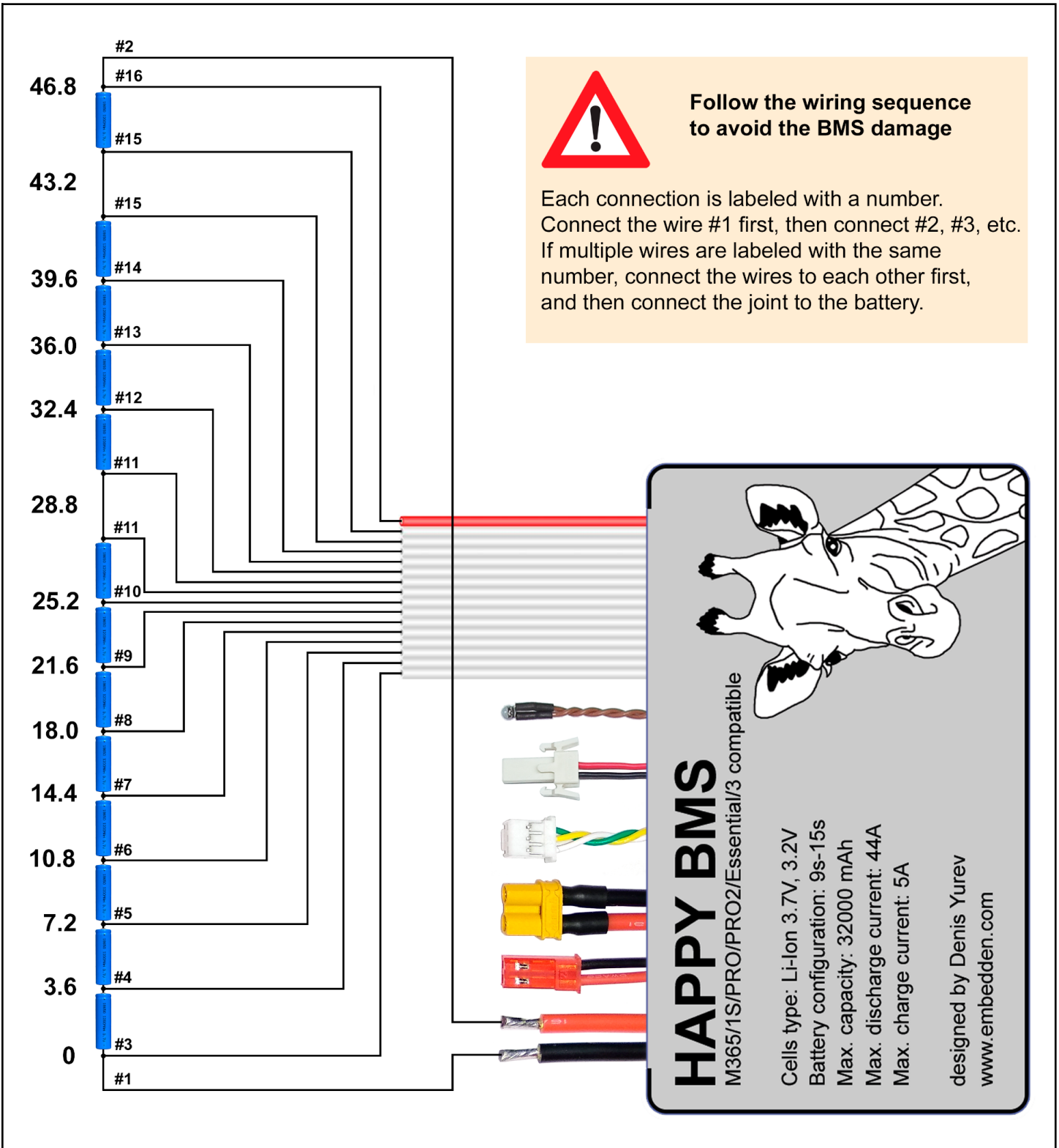
HAPPY BMS

M365/1S/PRO/PRO2/Essential/3 compatible

Cells type: Li-Ion 3.7V, 3.2V
Battery configuration: 9s–15s
Max. capacity: 32000 mAh
Max. discharge current: 44A
Max. charge current: 5A

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12s

#2
#15
43.2
#14
39.6
#14
36.0 #13
#12
32.4
#11
28.8
#10
25.2
#10
21.6 #9
#8
18.0
#7
14.4
#6
10.8
#6
7.2 #5
#4
3.6
0 #3
#1

**Follow the wiring sequence
to avoid the BMS damage**

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Connect the wire #1 first, then connect #2, #3, etc.
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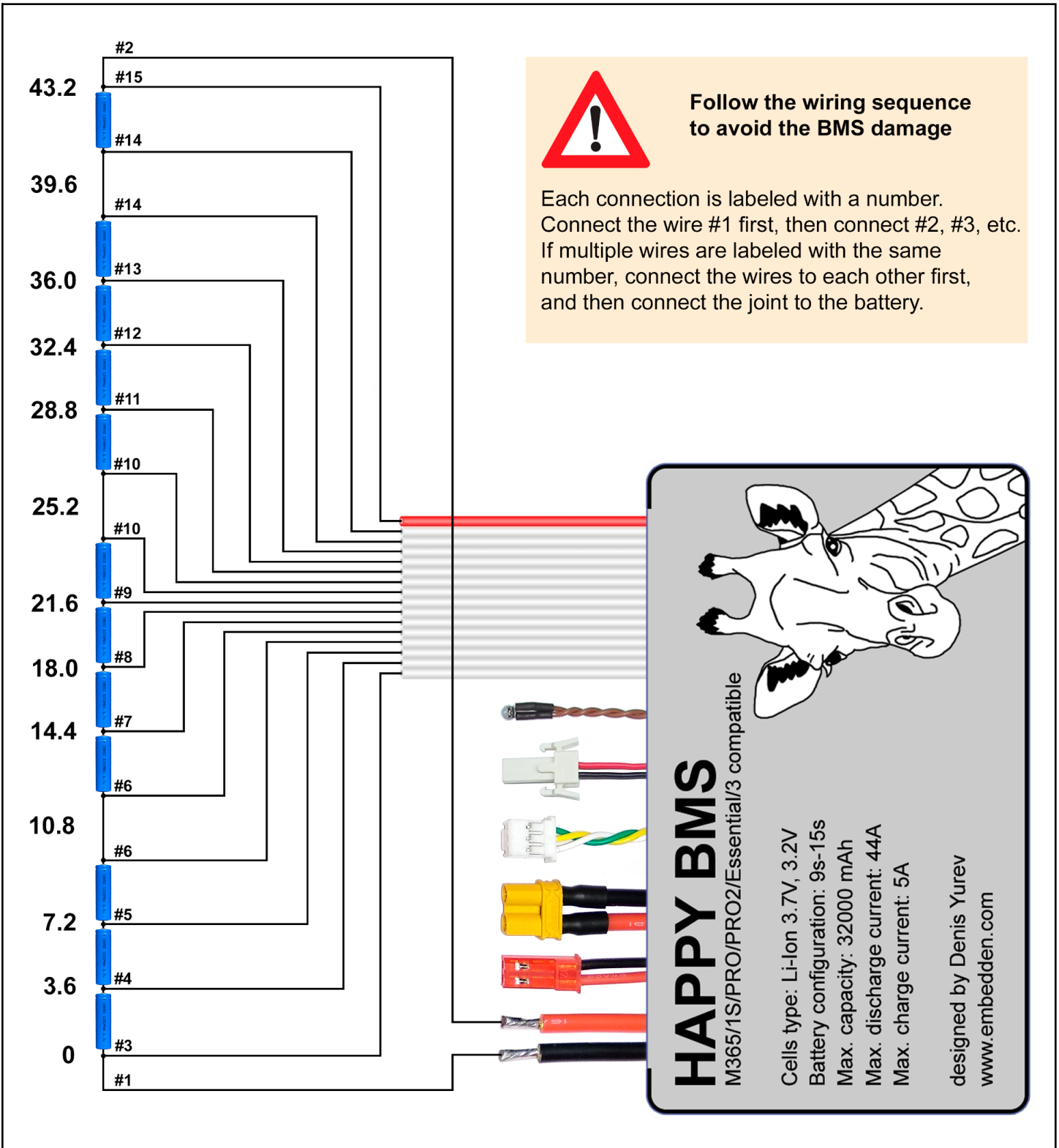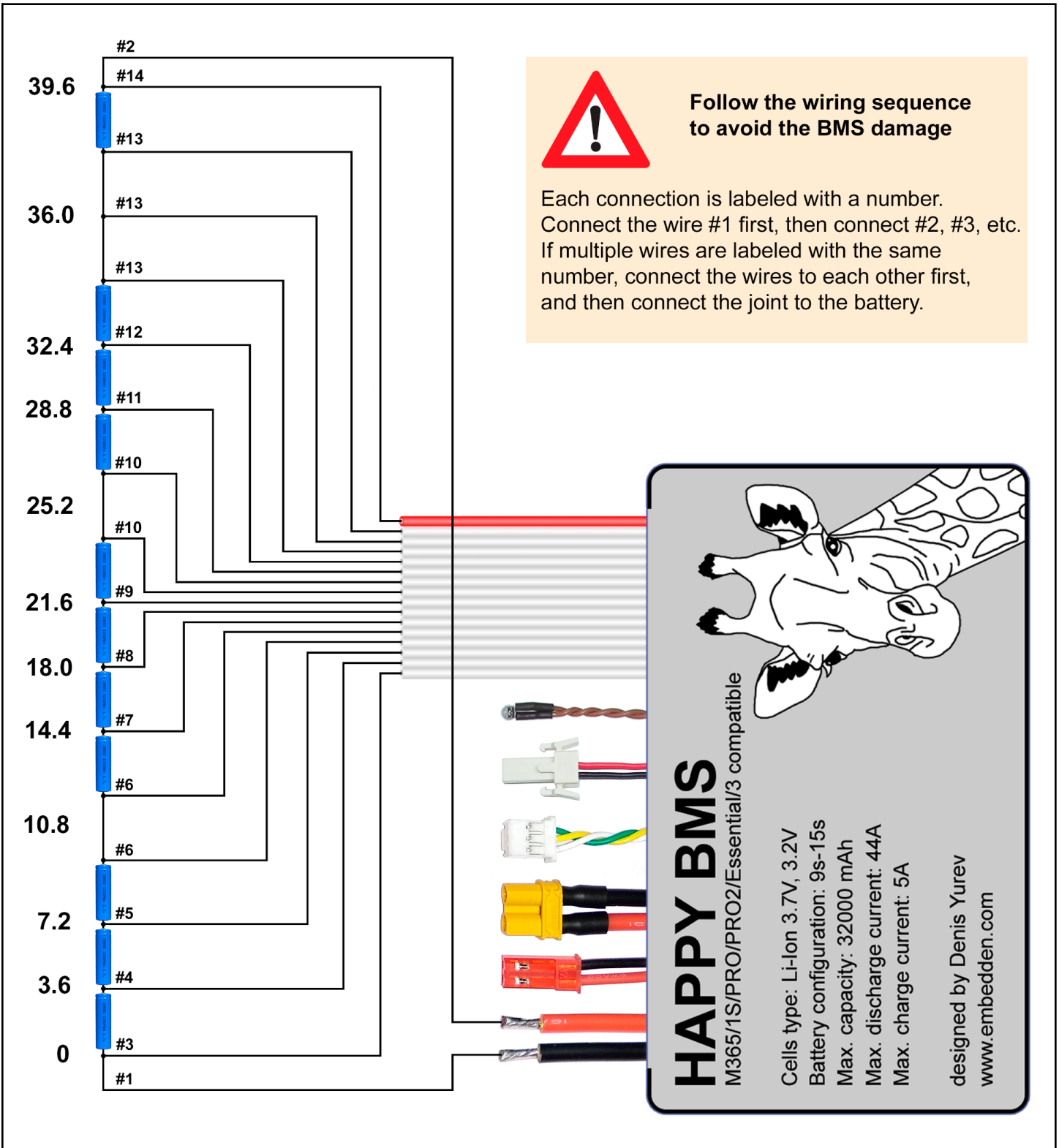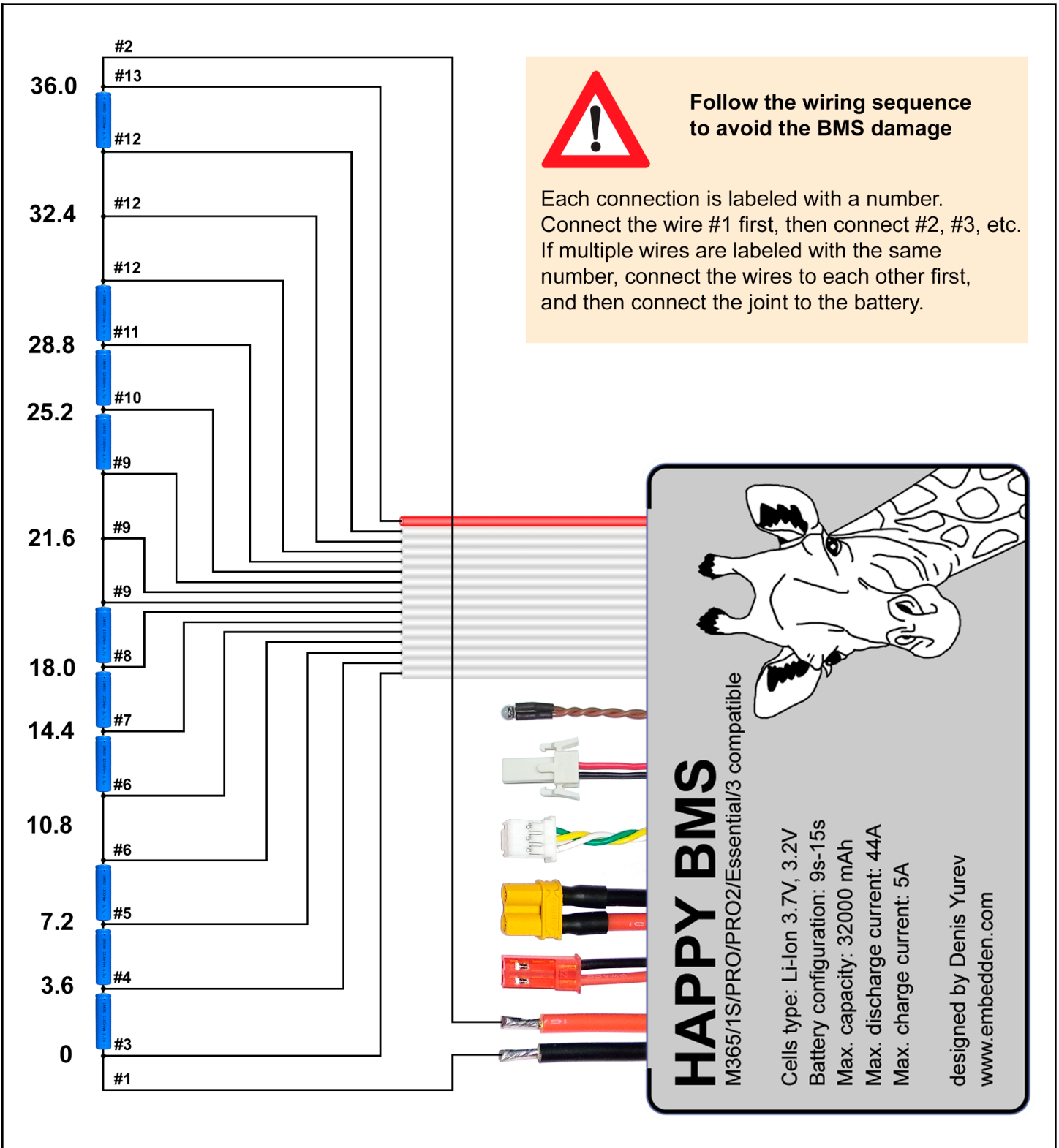and then connect the joint to the battery.

HAPPY BMS
M365/1S/PRO/PRO2/Essential/3 compatible

Cells type: Li-Ion 3.7V, 3.2V
Battery configuration: 9s–15s
Max. capacity: 32000 mAh
Max. discharge current: 44A
Max. charge current: 5A

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11s

Follow the wiring sequence to avoid the BMS damage

Each connection is labeled with a number. Connect the wire #1 first, then connect #2, #3, etc. If multiple wires are labeled with the same number, connect the wires to each other first, and then connect the joint to the battery.

HAPPY BMS
M365/1S/PRO/PRO2/Essential/3 compatible

Cells type: Li-Ion 3.7V, 3.2V
Battery configuration: 9s-15s
Max. capacity: 32000 mAh
Max. discharge current: 44A
Max. charge current: 5A

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10s

36.0 #2
#13

#12

32.4 #12

#12

28.8 #11

25.2 #10

#9

21.6 #9

#9

18.0 #8

14.4 #7

#6

10.8 #6

7.2 #5

3.6 #4

0 #3

#1

⚠️ **Follow the wiring sequence to avoid the BMS damage**

Each connection is labeled with a number. Connect the wire #1 first, then connect #2, #3, etc. If multiple wires are labeled with the same number, connect the wires to each other first, and then connect the joint to the battery.

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Max. charge current: 5A

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9s

#2
#12
32.4
#11

#11
28.8

#11
25.2
#10

#9
21.6
#8

#8
18.0
#8

#8
#7
14.4

#6
10.8
#5

#5
7.2

#5

#4
3.6

#3
0
#1

**Follow the wiring sequence
to avoid the BMS damage**

Each connection is labeled with a number.
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Battery configuration: 9s–15s
Max. capacity: 32000 mAh
Max. discharge current: 44A
Max. charge current: 5A

designed by Denis Yurev
www.embedden.com

Setting up the battery

You can configure many battery parameters if the battery is equipped with Happy BMS.
Please use the "M365 BMS Tool" application:

Download for Android

Download for iPhone
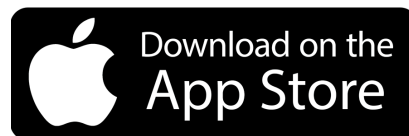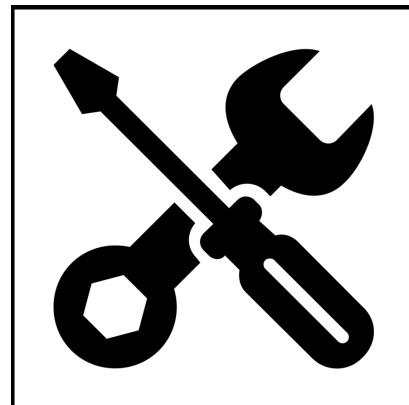
Parameters description

Parameter	Description
Battery serial	This parameter affects only the battery serial number displayed in applications. For example, put your name or your workshop name there.
Battery capacity	A very important parameter, it must be set correctly, otherwise the scooter will show the charge level wrongly during a ride.
Battery date of production	This parameter affects only the battery production date displayed in applications.
Discharge curve	Sets the correlation between the voltage of the most discharged parallel and the charge level, by 11 points. For example, by default, 0% is 2700mV, 10% is 3100mV, ..., 90% is 4000mV, 100% is 4100mV. These values are used for initial battery charge level calculation after the BMS launch. 100% point is also used for coulomb counter calibration, 4100 is the optimal value.
Charge overcurrent Charge overcurrent delay Charge overcurrent cooldown	If the charge current exceeds the "Charge overcurrent" value for longer than the "Charge overcurrent delay" time, then the BMS disables charging for "Charge overcurrent cooldown" time.
Discharge overcurrent Discharge overcurrent delay Discharge overcurrent cooldown	If the discharge current exceeds the "Discharge overcurrent" value for longer than the "Discharge overcurrent delay" time, then the BMS disables discharging for "Discharge overcurrent cooldown" time.
Short circuit current Short circuit delay Short circuit cooldown	If the discharge current exceeds the "Short circuit current" value for longer than the "Short circuit delay" time, then the BMS disables discharging for "Short circuit cooldown" time.
Cell overvoltage Cell overvoltage delay Cell overvoltage hysteresis	If at least one parallel voltage is higher than the "Cell overvoltage" value for longer than the "Cell overvoltage delay" time, then the BMS disables charging until all parallel voltages drop below the ("Cell overvoltage" - "Cell overvoltage hysteresis") value.
Cell undervoltage Cell undervoltage delay Cell undervoltage hysteresis	If at least one parallel voltage is lower than the "Cell undervoltage" value for longer than the "Cell undervoltage delay" time, then the BMS disables discharging until all parallel voltages rise above the ("Cell undervoltage" + "Cell undervoltage hysteresis") value.
BMS shutdown undervoltage	If at least one parallel voltage is below this value for more than 30 seconds, then the BMS turns itself off and remains off until it is launched again by connecting a charger. This feature prevents cells from being deeply discharged.

Parameters description(continuation)

Parameter	Description
Balancing mode	There are 3 balancing options: Always - to balance the cells always. Charging&overvoltage - to balance the cells during charging or when the battery is almost fully charged. Never - never balance the cells.
Lowest voltage to balance	A cell group will not be balanced if its voltage is below the "Lowest voltage to balance" value.
Cells disbalance threshold	If the voltage of a cell group exceeds the lowest voltage cell group more than the "Cell Imbalance Threshold", then the balancing of the group starts.
Cells dsg. max. temperature	If the cells temperature exceeds this value, then the BMS disables discharging until the cells temperature drops below the ("Cells dsg. max. temperature" - "Cells temperature hysteresis") value.
Cells dsg. min. temperature	If the cells temperature drops below this value, then the BMS disables discharging until the cells temperature exceeds ("Cells dsg. min. temperature" + "Cells temperature hysteresis") value.
Cells chg. max. temperature	If the cells temperature exceeds this value, then the BMS disables charging until the cells temperature drops below the ("Cells chg. max. temperature" - "Cells temperature hysteresis") value.
Cells chg. min. temperature	If the cells temperature drops below this value, then the BMS disables charging until the cells temperature exceeds ("Cells chg. min. temperature" + "Cells temperature hysteresis") value.
Cells temperature hysteresis	See the explanation above.
BMS max. temperature	If the BMS temperature exceeds this value, then the BMS disables discharging and charging until the BMS temperature drops below the ("BMS max. temperature" - "BMS temperature hysteresis") value.
BMS temperature hysteresis	See the explanation above.
Reset to defaults	Set the 12876 value to restore factory default BMS settings

Default parameters values

Parameter	Default value
Battery serial	"DEFAULT VALUES"
Battery capacity, mAh	20000
Battery date of production	19.07.2021
Discharge curve, mV	2700, 3100, 3500, 3600, 3700, 3750, 3800, 3850, 3900, 4000, 4100
Charge overcurrent, A	3.5
Charge overcurrent delay, ms	1000
Charge overcurrent cooldown, s	30
Discharge overcurrent, A	44
Discharge overcurrent delay, ms	1280
Discharge overcurrent cooldown, s	30
Short circuit current, A	155
Short circuit delay, us	70
Short circuit cooldown, s	30
Cell overvoltage, mV	4200
Cell overvoltage delay, s	2
Cell overvoltage hysteresis, mV	100
Cell undervoltage, mV	2700
Cell undervoltage delay, s	4
Cell undervoltage hysteresis, mV	150
Balancing mode	Charge&Overvoltage
BMS shutdown undervoltage, mV	2500
Lowest voltage to balance, mV	3600
Cells disbalance threshold, mV	30
Cells dsg. max. temperature, °C	60
Cells dsg. min. temperature, °C	-5
Cells chg. max. temperature, °C	40
Cells chg. min. temperature, °C	5
Cells temperature hysteresis, °C	5
BMS max. temperature, °C	90
BMS temperature hysteresis, °C	10

Troubleshooting

<u>Trouble</u>:

      The battery does not work, the BMS indication LED does not blink.

<u>Solution</u>:

1. Connect a charger: normally it starts the BMS.
2. Check the wiring.
3. Make sure that every cell group is fine: the group voltage must be between 2.5V and 4.2V.

<u>Trouble</u>:

      The BMS starts up, but shuts down 30 seconds later.

<u>Solution</u>:

      Make sure that every cell group voltage is higher than the "BMS shutdown undervoltage" value. If at least one cell group voltage is below the value, leave a charger connected until the voltages are fine.

<u>Trouble</u>:

      The BMS indication LED blinks, but the scooter does not turn on.

<u>Solution</u>:

1. Check the battery output voltage. If it is in the range between 25V and 63V, the BMS and the battery pack are fine, so the problem is not related to the battery, and you have to diagnose other scooter modules.

2. If the battery output voltage is below 25V, pay your attention at the BMS indication LED:

   a) Double short flash every second - there is a balancing wires connection issue. Some wires are not connected or connected the wrong way.
   b) Long(0.5-1s) flashes - the temperature protection has tripped. The cells temperature is too high or too low, or the BMS temperature is too high, or the temperature sensors are broken.
   c) Short flash every 4 seconds - at least one of the cell groups is completely discharged, the battery discharging is prohibited by the BMS, charging is required.
   d) Short flash every 1 second - the battery is in a standby state and is ready to be charged or discharged. This is a typical battery condition when the scooter is off and not charging. If the indicalion LED blinks this way, but the battery output is below 25V - the BMS board or the output wires/plug are damaged.
   e) Short flash every 0.5 second - the battery is in an active state: charging, discharging, or data exchanging. If the indicalion LED blinks this way, but the battery output is below 25V - the BMS board or the output wires/plug are damaged.
   f) Continuous flash - the overcurrent protection has tripped. You have to wait about 30-60 seconds for the protection cooldown.

<u>Trouble</u>:

There was a spark when I plugged the battery into the controller. I am getting a continuous LED flash after connecting the battery to the controller, there is no power at the battery output, it's not possible to turn on the scooter.

<u>Solution</u>:

Sometimes ESC capacitors initial charging current trips the overcurrent protection. If it happens, just leave the battery connected for a few trip-cooldown cycles, until the capacitors are fully charged and do not trip the protection anymore. Or use some anti spark solutions to charge the ESC capacitors before plugging the battery in.

Warranty and technical support

We do not accept returns and do not provide warranty because there are many cases when unqualified customers fry the BMS by wrong wiring, and then require a warranty exchange. Unfortunately we are not able to provide warranty, paying for every failure of not qualified enough customers.

If you did not find the answer to your question after reading this manual, please join our support Telegram group:

[E-scooters Upgrade Workshop by Denis Yurev](#)