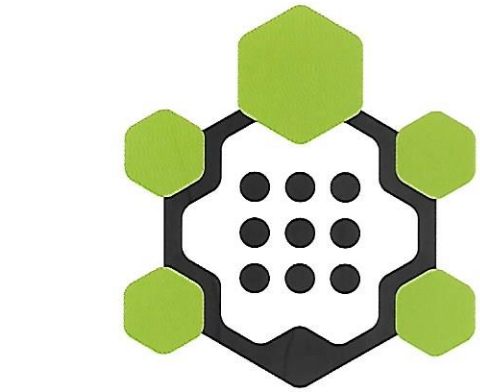
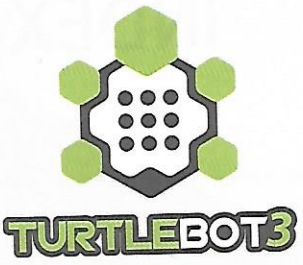
English 中文 日本語 한국어



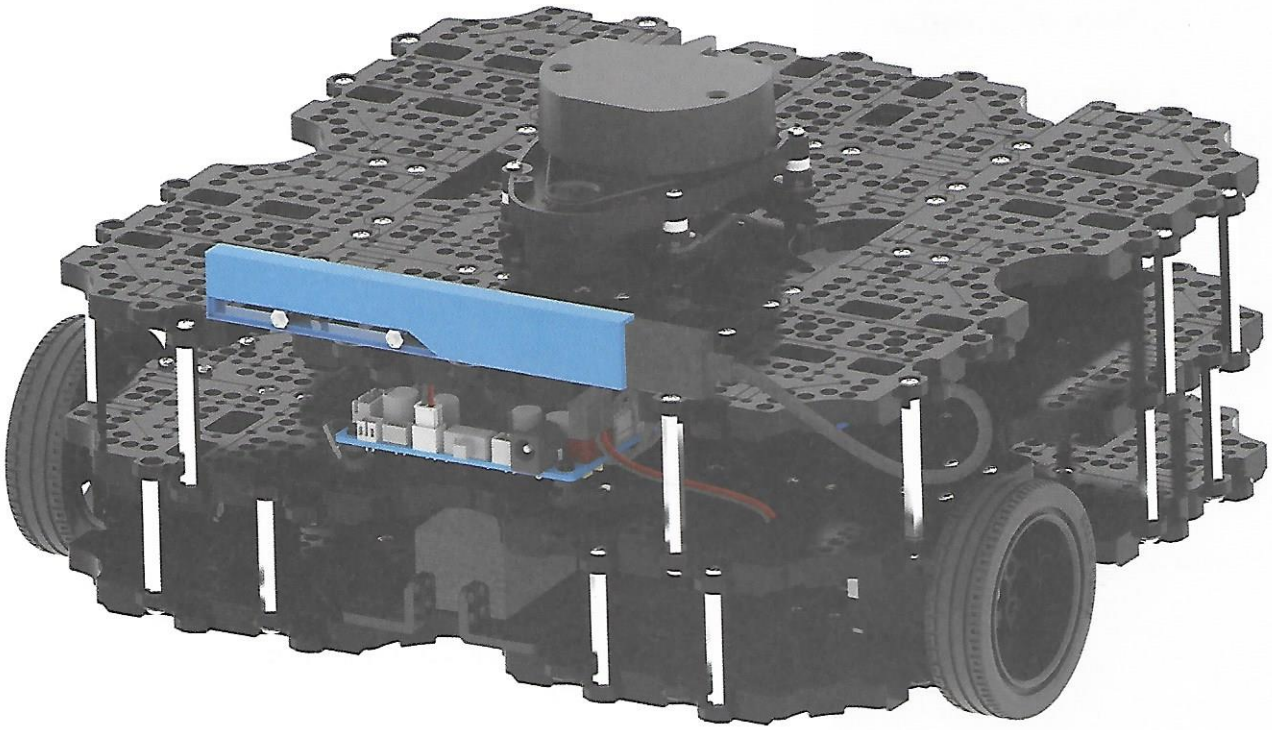
TURTLEBOT3

Waffle

ROBOTIS



Waffle



http://www.turtlebot.com
http://turtlebot3.robotis.com

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TURTLEBOT3 Waffle Quick Start

1 Precautions

☑ Please be aware of your own safety as you assemble. ROBOTIS CO., LTD is not responsible for the result of any accidents caused by the user's negligence.

A. Safety Precautions

1. Read through the manual carefully before assembly.
2. Do not use any other tools other than those provided in this kit. (no knives, cutters, drills, etc.)
3. Keep a safe distance from the robot during its activation.
4. Be careful not to get fingers stuck between the robot joints and wheels.
5. Do not store or operate the robot under direct sunlight.
6. This product is not water proof. Do not use the robot near water.
7. Do not use the robot near heat or fire.
8. Do not disassemble or modify the parts.
9. Keep all parts out of reach of infants.
10. Do not drop or use sharp objects with the parts.
11. Do not soak or place the Li-Po battery in or near water.
12. Do not connect or let the Li-Po battery come in contact with hair pins, clips, or any metal objects.
13. Do not bend, twist, or modify the Li-Po battery and its connector.
14. Do not place the Li-Po battery in the microwave.
15. Do not solder any part of this product.
16. Do not eat any part of this product.
17. Use only the designated screw driver in the kit.
18. Do not use excessive force on nuts, bolts, or robot parts.
19. Avoid activating the robot on desk or table to avoid from falling.
20. Damages caused from falling are not covered under warranty.
21. The gears in the DYNAMIXEL XL430 or XM430 are subject to wear. Prolonged use, improper modifications, excessive force, and accidents will increase the gear to backlash.

2 Key Parts and Instructions

A. Screw/Screw Driver

1. Screws are used to firmly fasten the key joints of the TurtleBot3. Red circles on the right image are the holes where the screw is inserted in.
2. Please only use the assigned screw driver when fastening or loosening the screw.

B. Rivet Tool

1. The rivet tool is used to remove the fastened rivets.
   Grab the pin with the rivet tool. Pull upwards to remove the rivet.

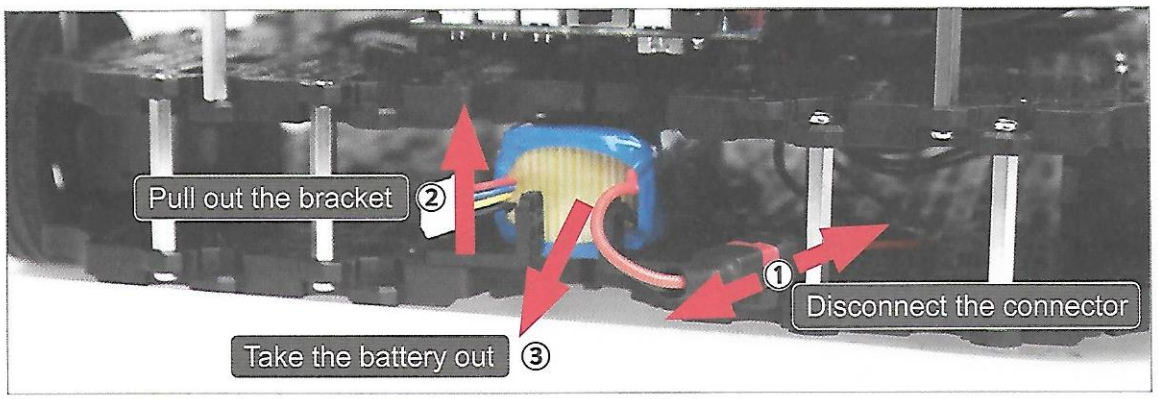
C. Cable

1. Take caution of the port and connector's shape when connecting the cables.
2. When disconnecting the cable, please pull the connector, not the cable itself. Pulling the cable may result in damaging the cable.

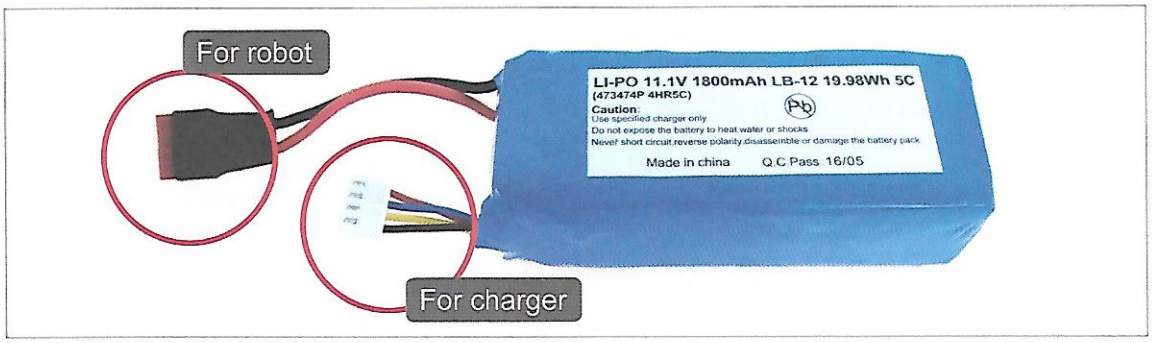
D. Li-Po Battery

When the robot makes the low battery warning sound, please take out the battery from the robot and charge it. The LED of charger will turn into red when it starts charging and change into green again when completed.

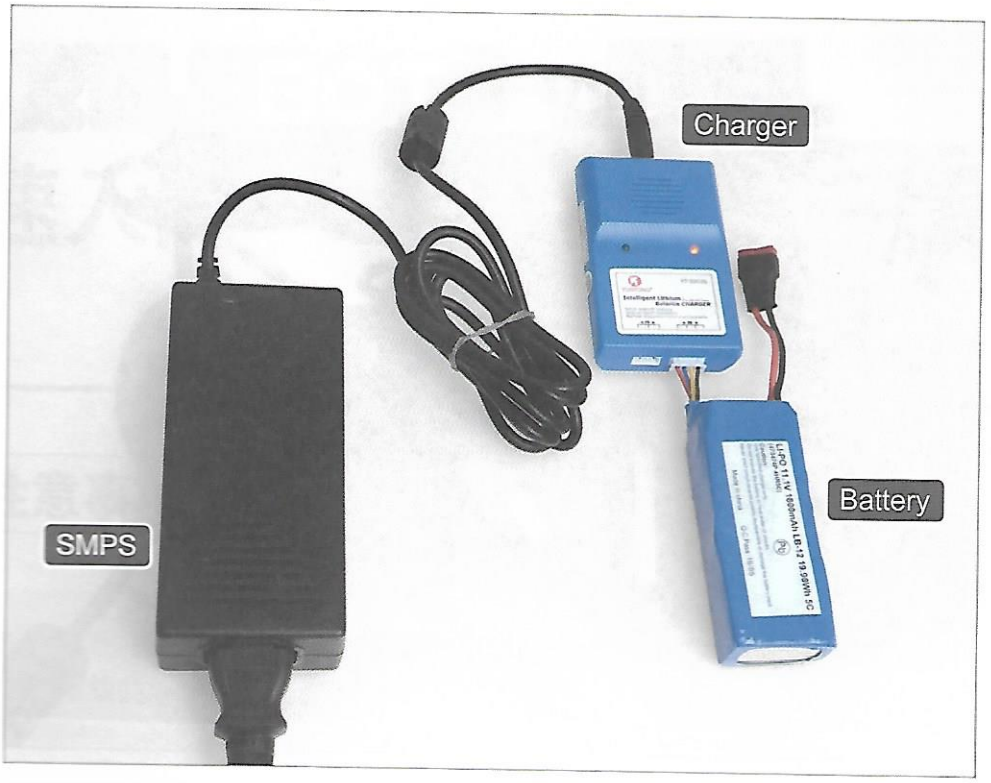
1. Take the battery out.



2. There are two connectors on the battery. One is for the robot and the other is for the charger.



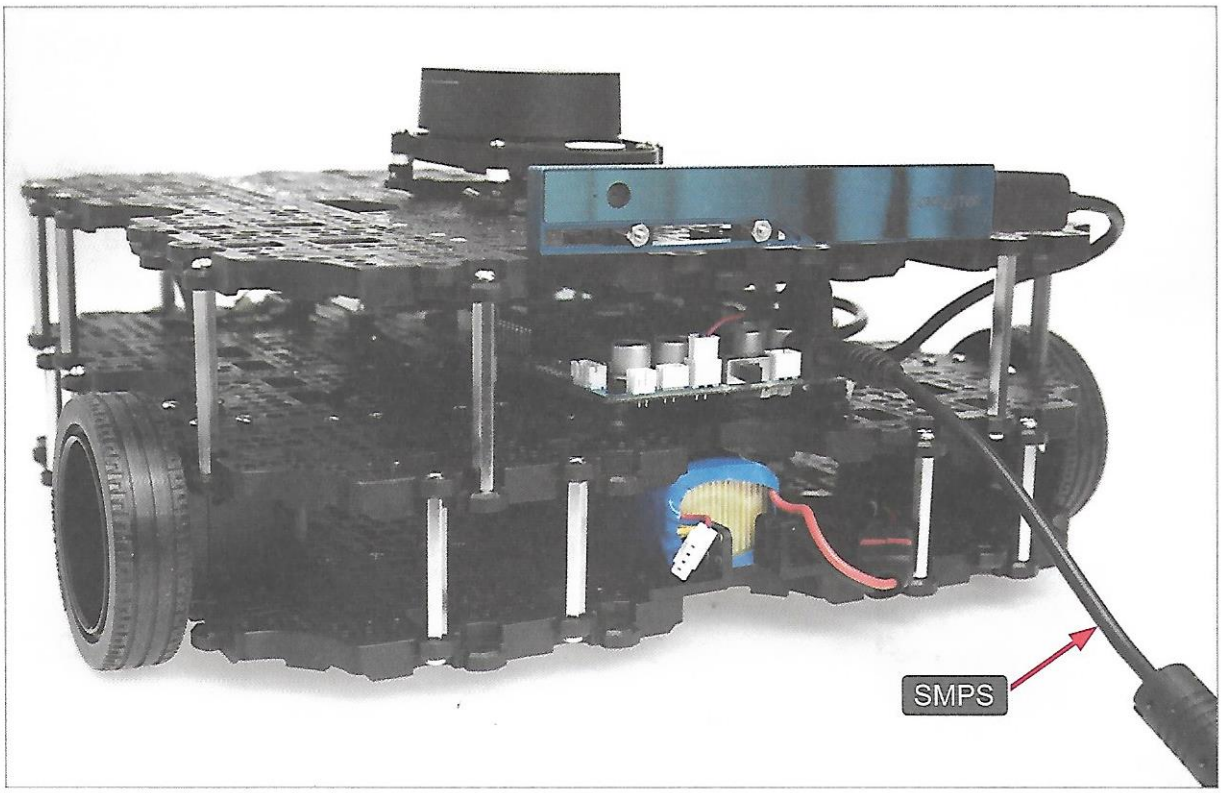
3. Connect to the charger



4. Charge

Charging
(LED: Red)

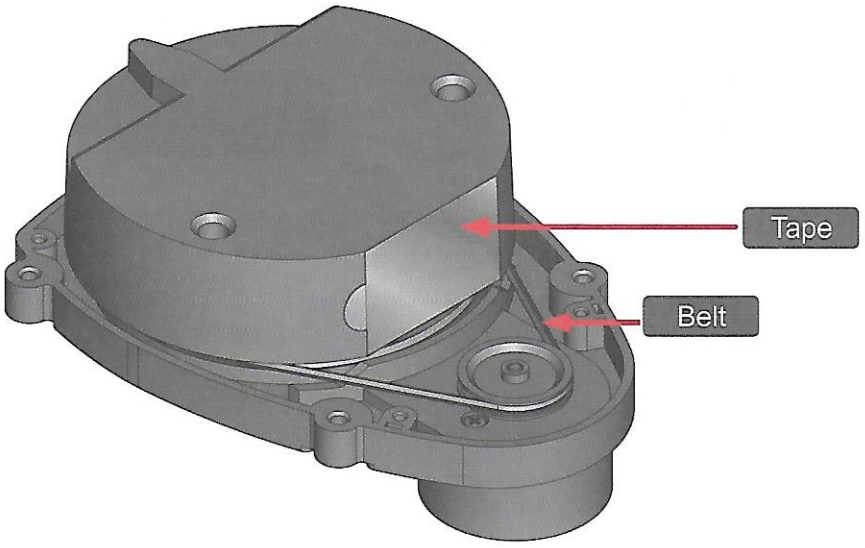
Completed
(LED: Green)



If you connect the SMPS directly to the robot, the battery can be removed from the robot for charging while the robot is remaining online.

E. LDS (Laser Distance Sensor)

(1) Please remove the protective tape before use.
(2) After removing the tape, do not touch the sensing area to protect from stain.
(3) Do not touch the belt.
(4) Do not disassemble this LDS.
(5) Do not apply impact to this LDS.



TURTLEBOT3 Waffle 快速入门

1 注意事项

☑ **请知悉，当您组装机器人时需要注意您的安全。ROBOTIS公司对于因用户的疏忽而产生的任何事故的后果概不负责。**

A. 安全须知

1. 在组装前，请仔细阅读手册。
2. 请勿使用套件中的物品以外的工具。(请勿使用刀具、切割机、钻头等)
3. 请在机器人运行时与机器人保持安全距离。
4. 请注意不要让手指夹在机器人的关节之间。
5. 请勿将机器人在直射阳光下保管或运行。
6. 本套件并非防水产品，请勿让机器人靠近水。
7. 请勿在高温环境下使用。请勿靠近热源或火气。
8. 请勿任意分解或改造部件。
9. 请勿让小孩接近部件。
10. 请勿将锂聚合物电池放入水中或接近水。
11. 请勿将锂聚合物电池浸泡或放入水中或接近水。
12. 请勿将锂聚合物电池与发夹、回纹针、或其它任何金属物体接触。
13. 请勿弯曲、扭转或改造锂聚合物电池以及接头。
14. 请勿将锂聚合物电池放进微波炉。
15. 请勿对产品的任何部件进行焊接。
16. 请勿食用产品的任何部件。
17. 请只使用套装提供的螺丝刀。
18. 请勿对螺母、螺钉或其它机器人部件过度用力。
19. 为了防止机器人掉落，请勿将机器人在桌子上开启。
20. 因掉落引起的故障并非保修对象。
21. DYNAMIXEL XL430或XM430里的齿轮是损耗件。
    长期的使用、不适当的改造、过度受力及事故会增加齿轮的齿隙。

2 重要部件及说明

A. 螺钉/螺丝刀

1. 螺钉用于牢牢固定住TurtleBot3的重要关节。
   右侧图示中标注的红色圆圈表示需要插入螺钉的孔。
2. 请只使用套件提供的螺丝刀拧紧或拧松螺钉。

B. 钉组工具

1. 钉组工具用于拔出钉组。
   先用钉组工具扣住钉子的钉头,之后往上抬起,以此拔出钉组。

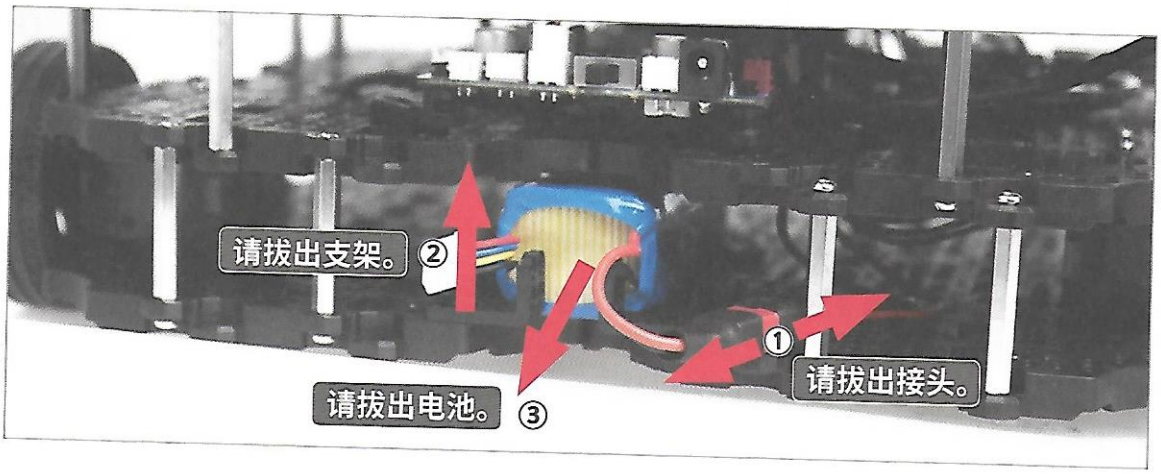
C. 连线

1. 在接线之前请务必留意接头的形状和方向。
2. 在分离电线时请拉住接头,而不是拉住电线。拉起电线部分会损坏电线。

D. 锂聚合物电池

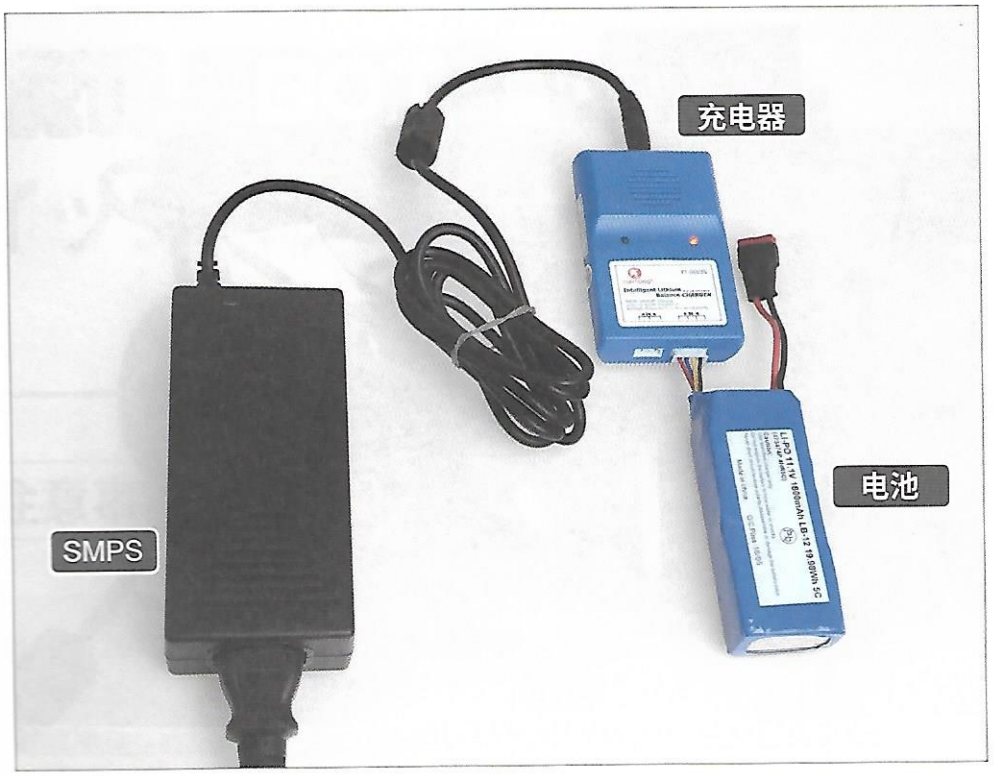
当机器人发出低电压警报时,请立即将电池取出并充电。开始充电后充电器会亮起红灯;当充电完毕后会亮起绿灯。

1. 拿出电池



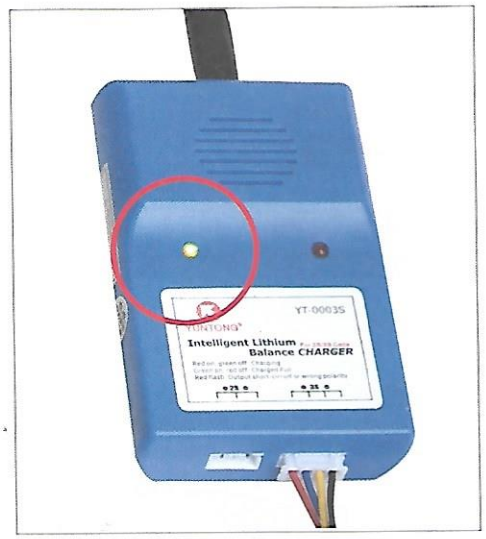
2. 电池上有两个接头。一个是用于给机器人供电,一个是用于充电。

3. 连接到充电器

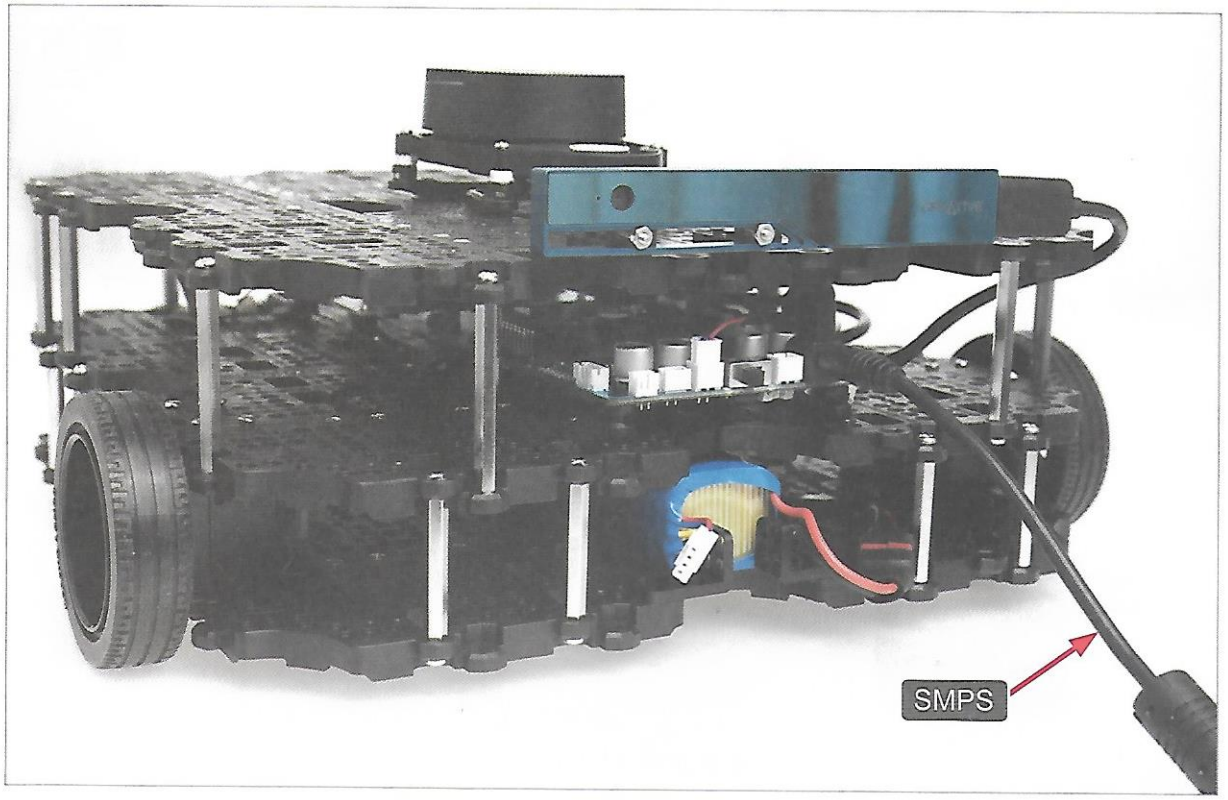


4. 充电

充电中
(红LED灯)



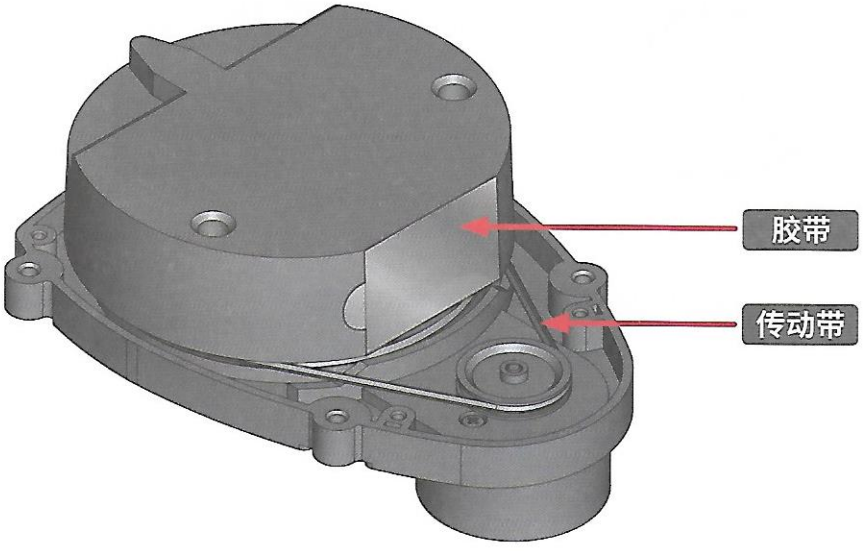
充电完毕
(绿LED灯)



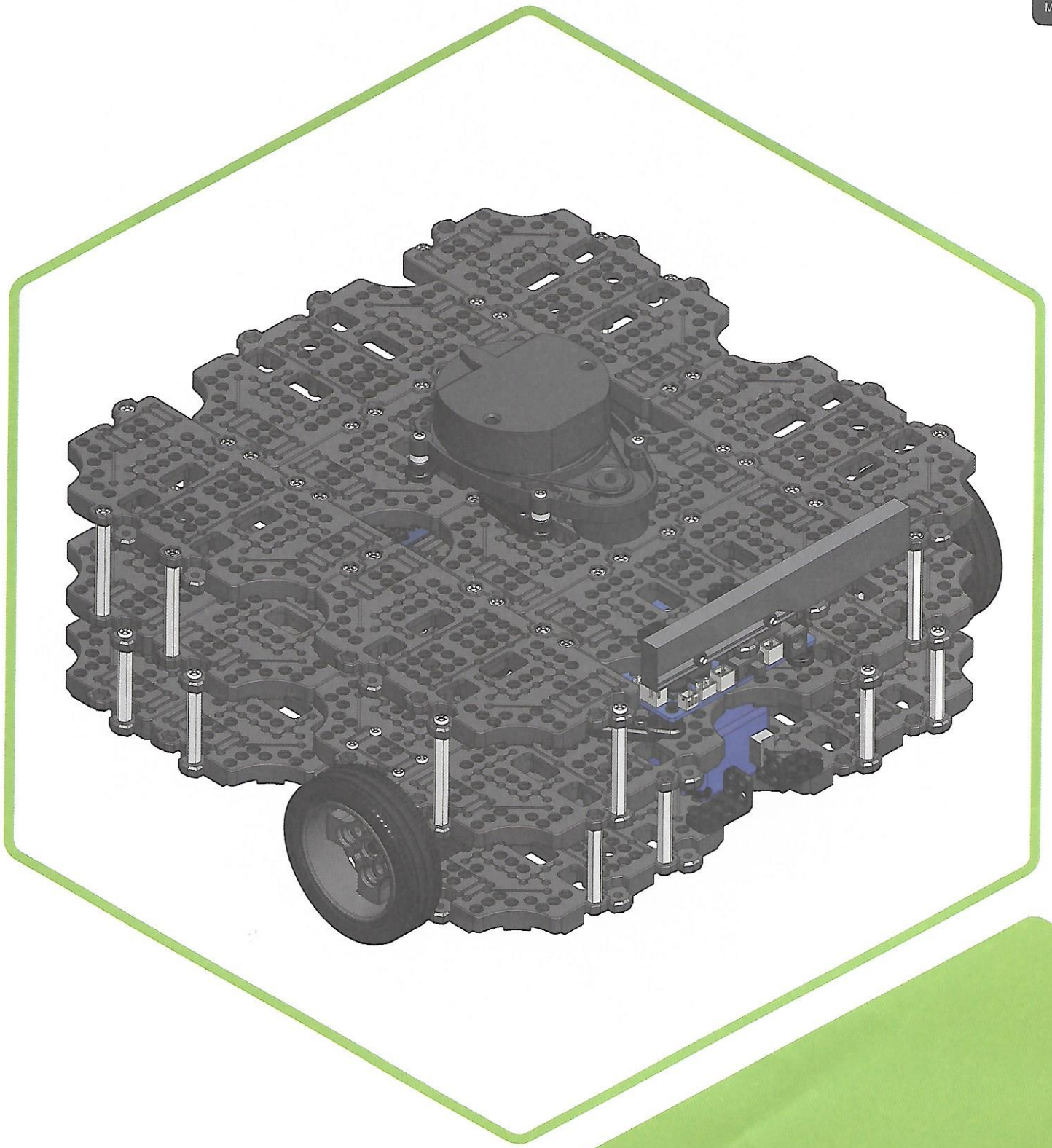
将电源适配器直接连到机器人,可以在维持机器人运作的状态下拔出电源。

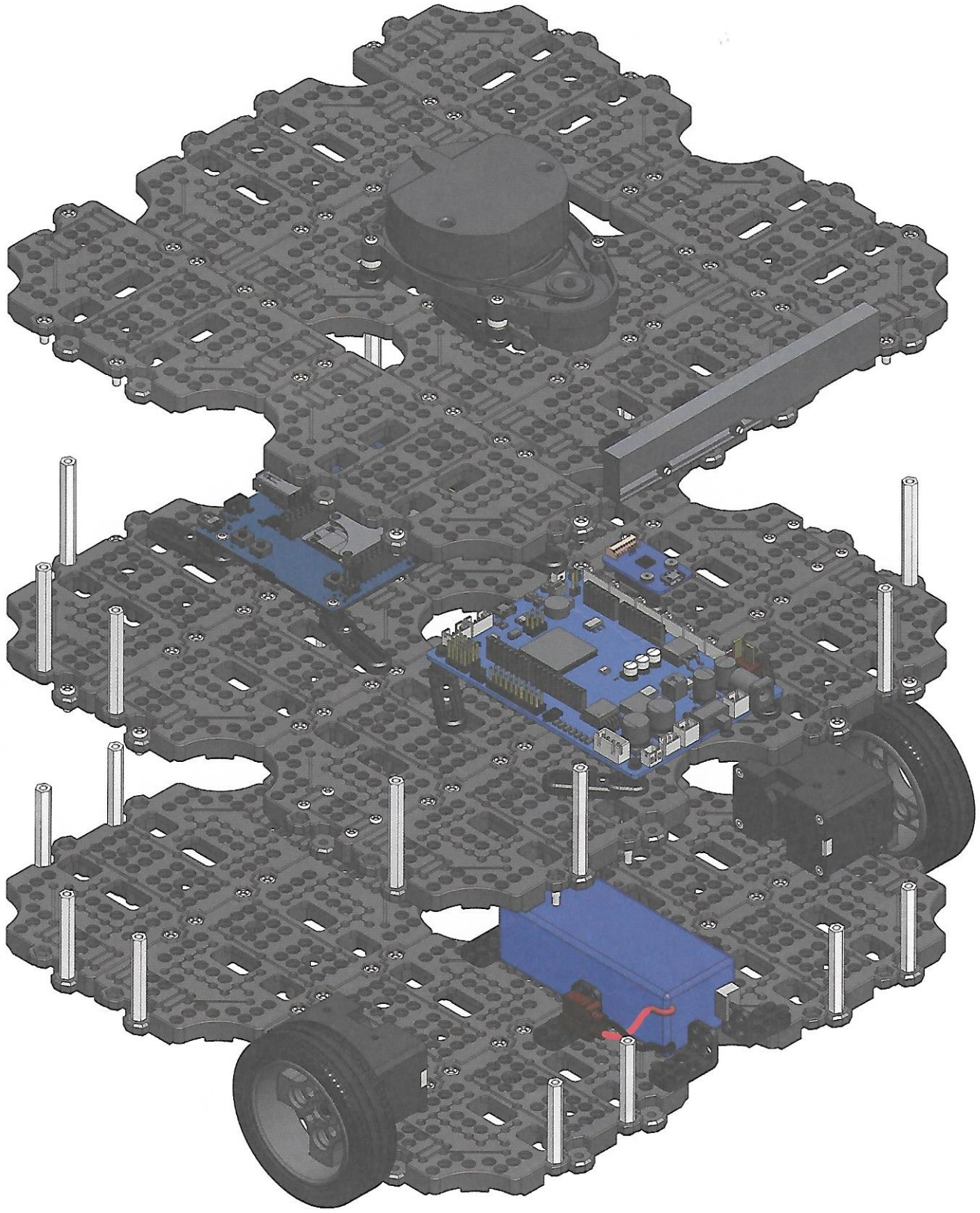
E. LDS (激光距离传感器)

(1) 请在使用前除去保护用胶带。
(2) 除去胶带之后,请勿触碰或弄脏传感区域。
(3) 请勿触碰传动带。
(4) 请勿分解LDS。
(5) 请勿使LDS受到冲击。



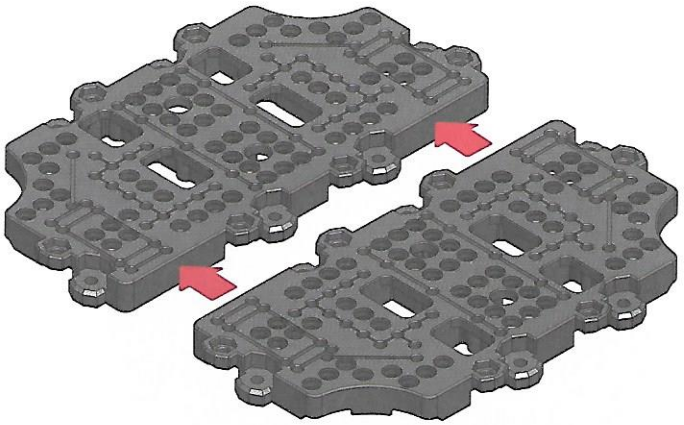
TURTLEBOT3 Waffle



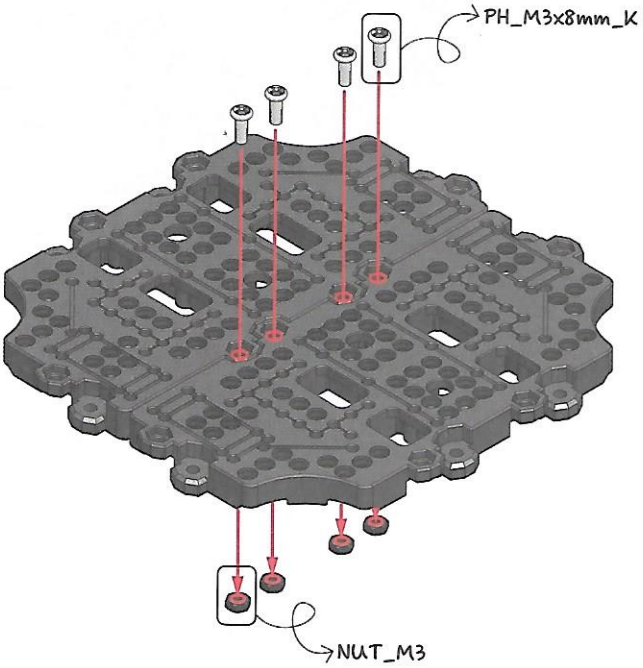


Waffle-Plate Assembly

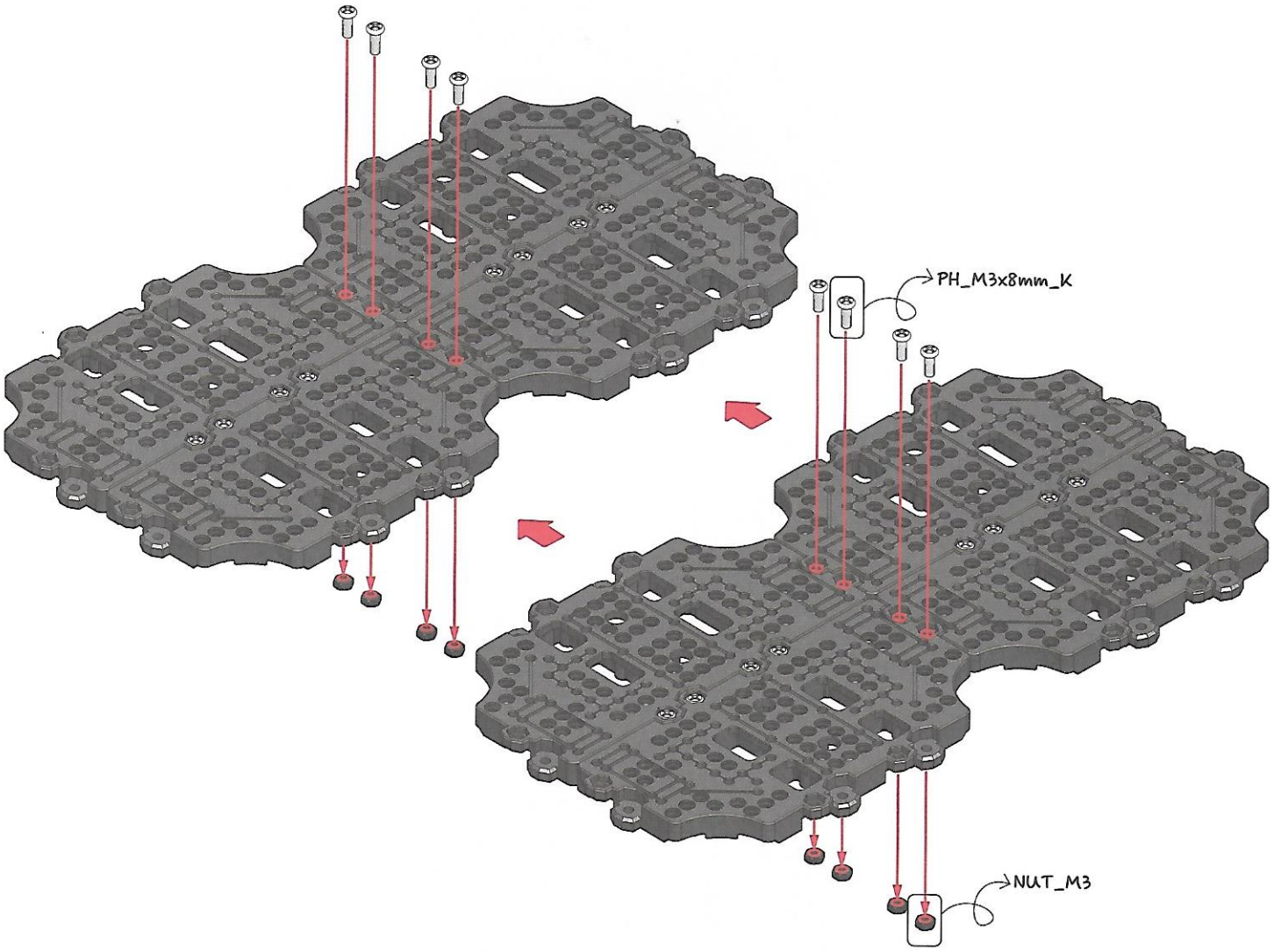
Assemble two ***Waffle-Plates***

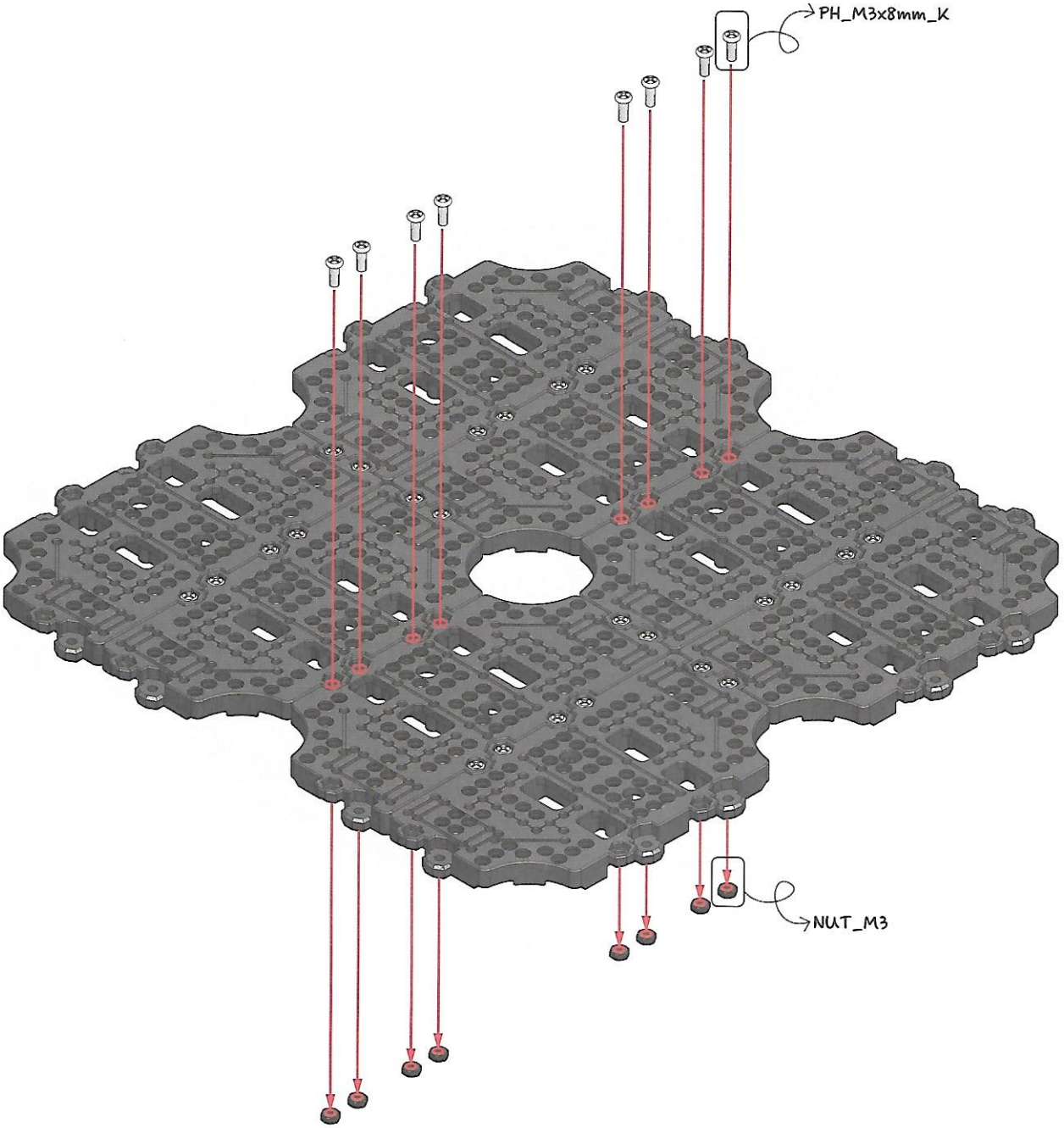


Insert ***PH_M3×8mm_K*** from the top of the ***Waffle-Plate***



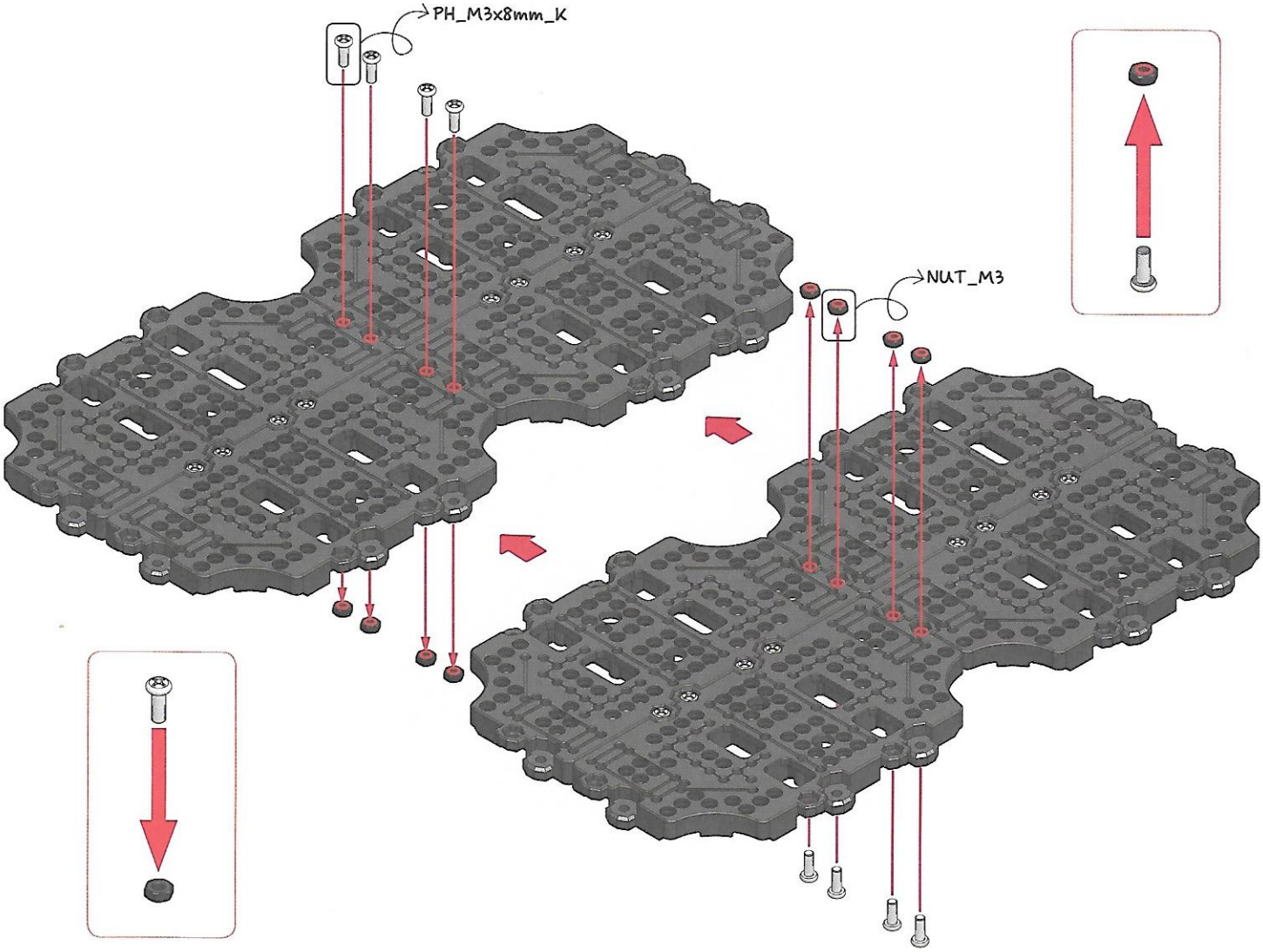
Layer (First)

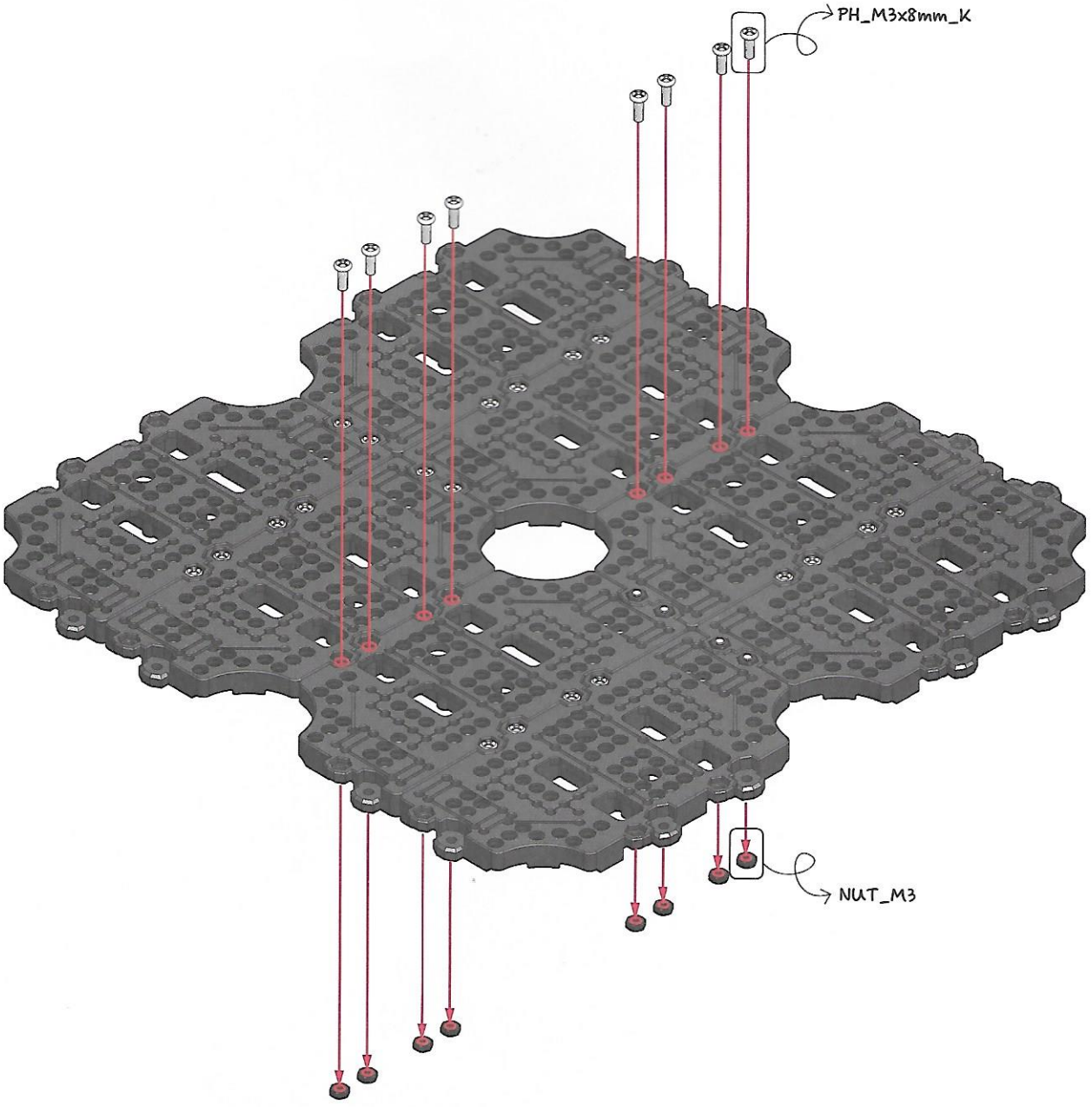



PH_M3x8mm_K
NUT_M3

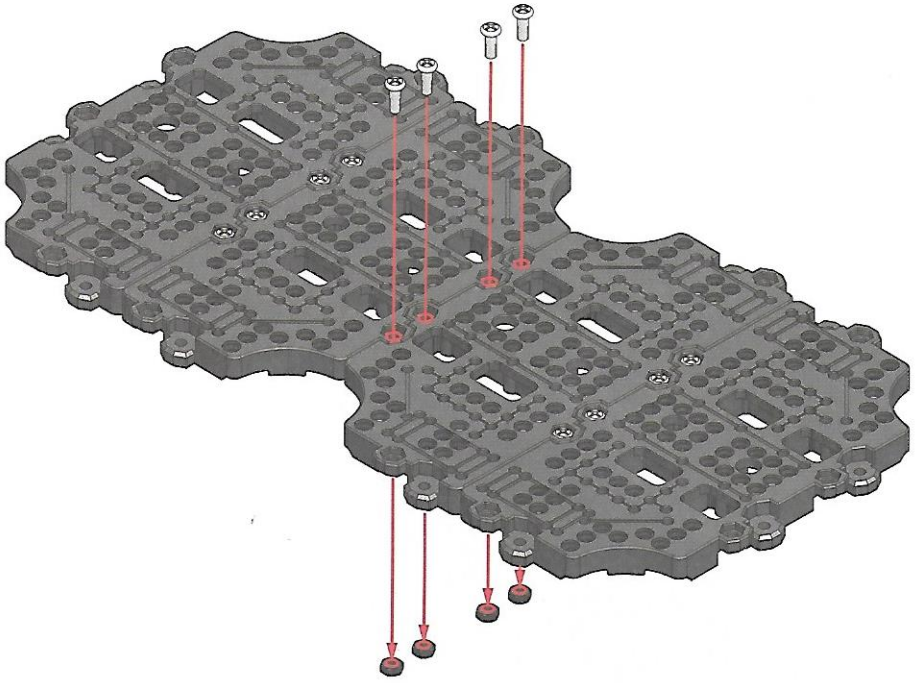
Layer (Second)

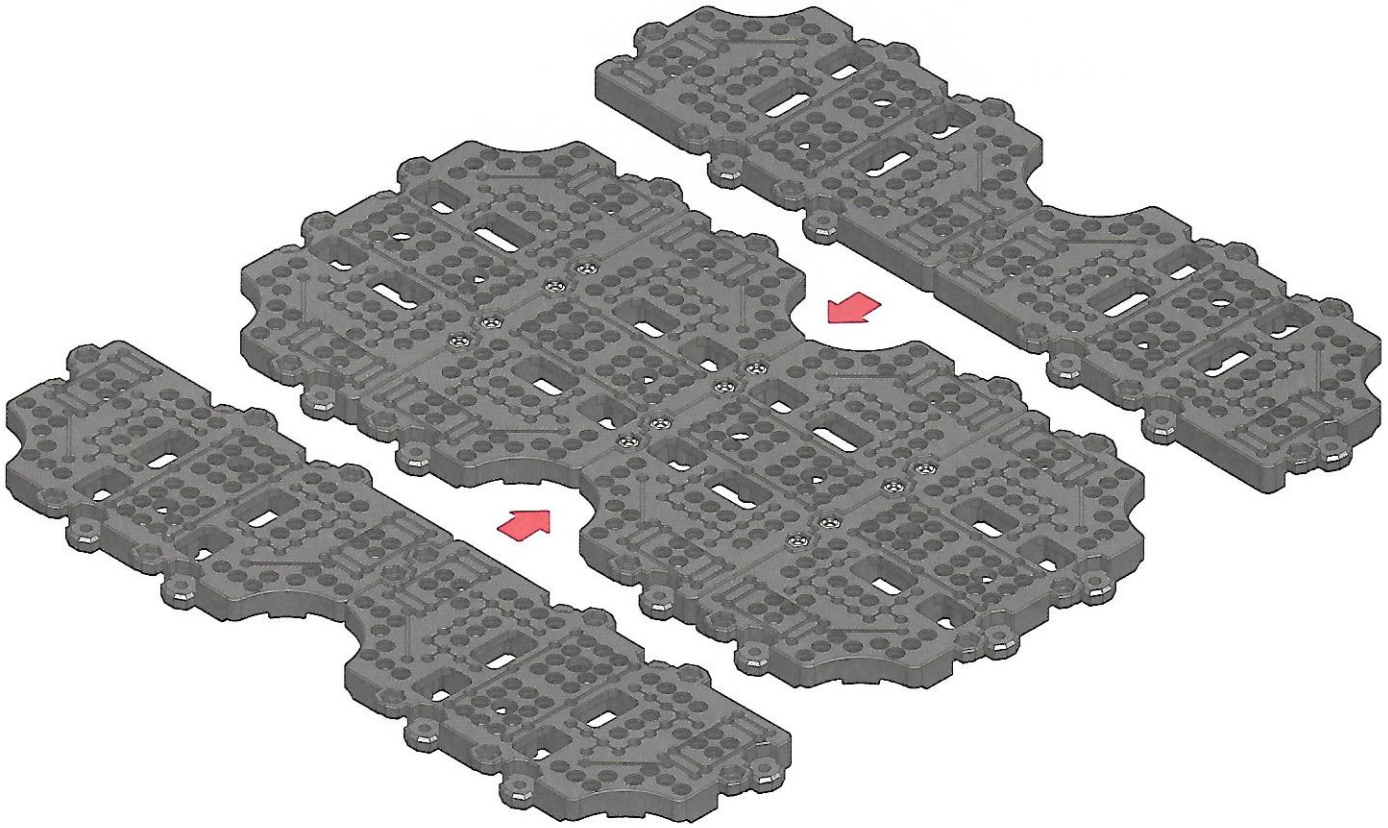
To avoid any damages on ***Li-Po Battery*** that can be caused from bolt edges, battery side bolts should be inserted from underneath the ***Waffle-Plate*** to prevent scratching the ***Li-Po Battery***

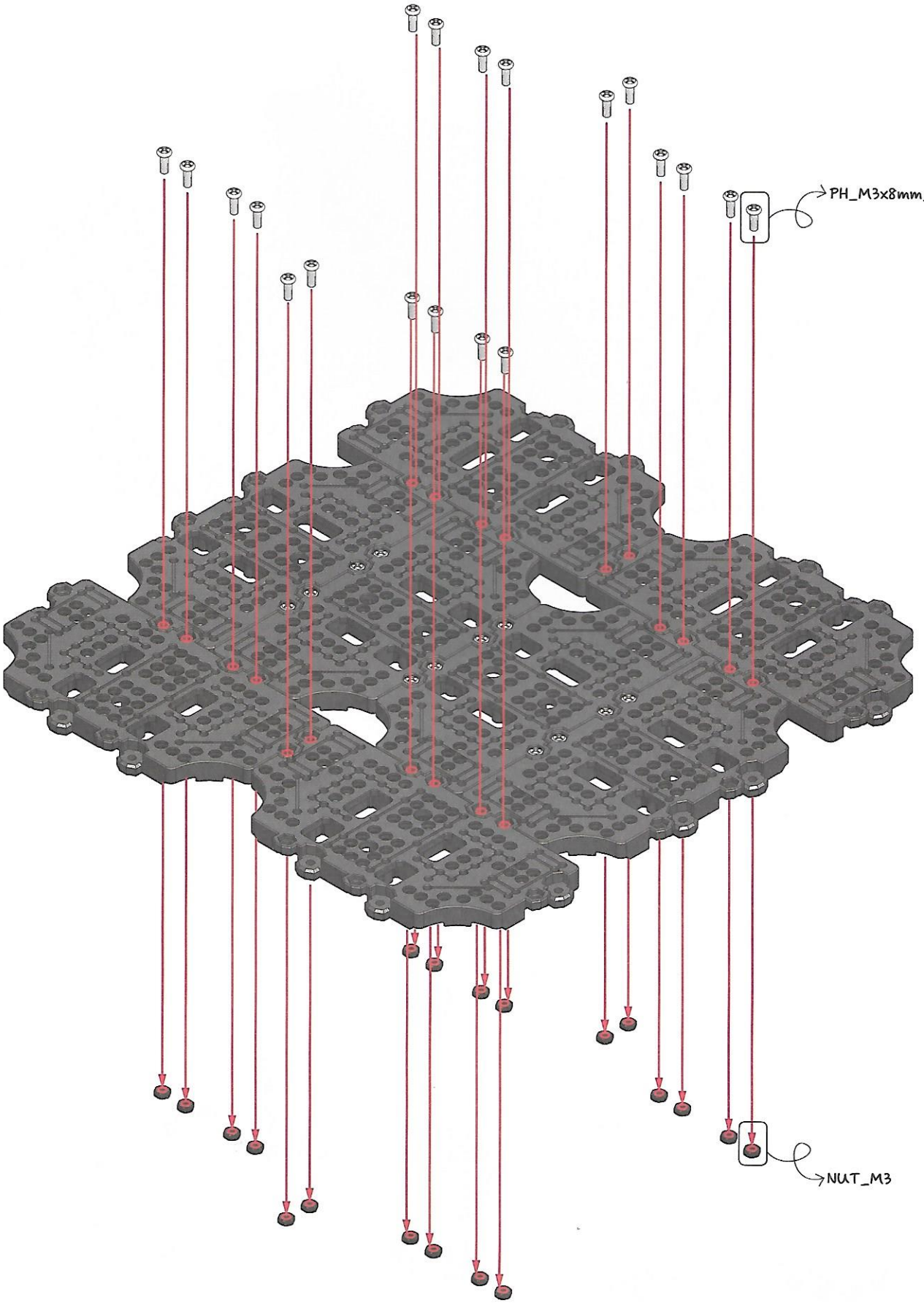



PH_M3x8mm_K
NUT_M3

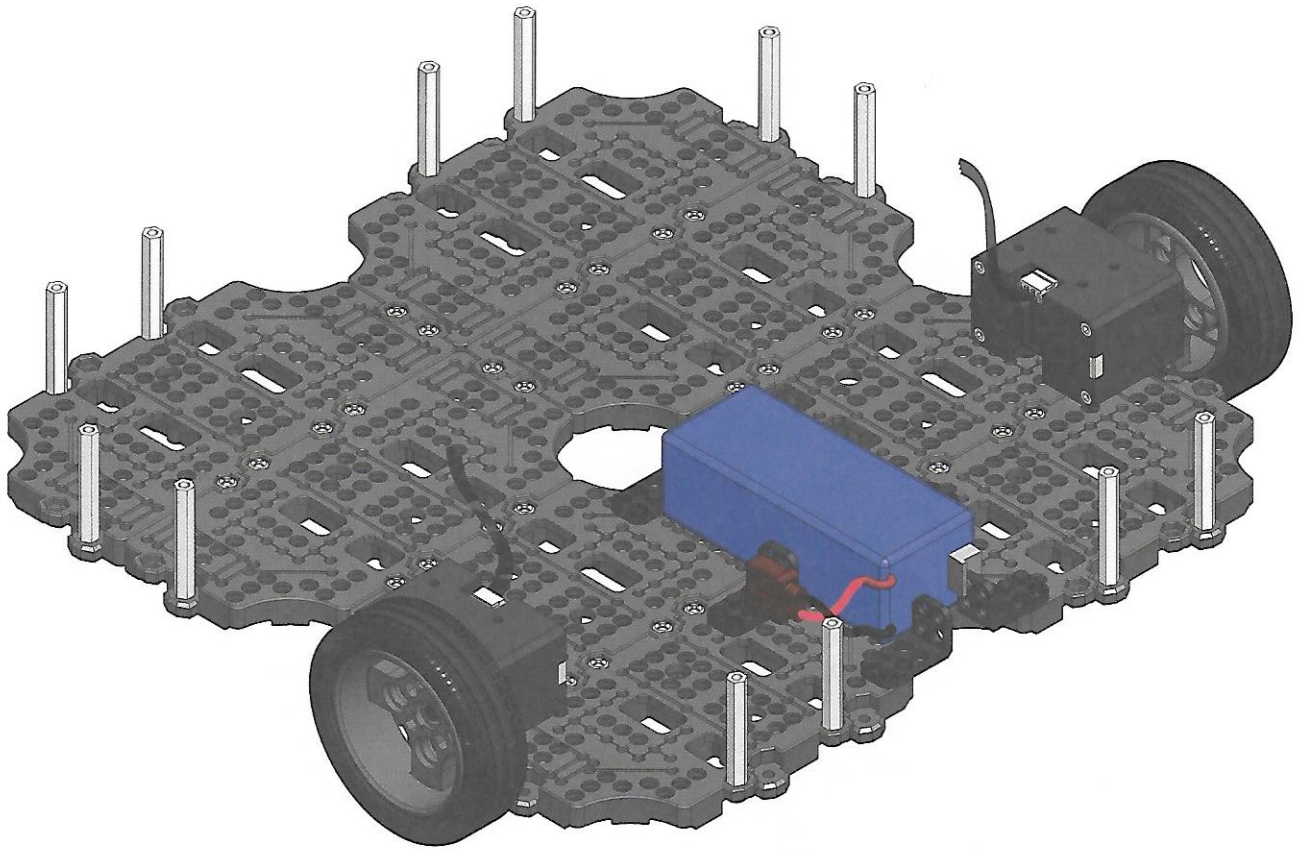
Layer (Third)






PH_M3x8mm_K
NUT_M3

First Layer Assembly



PH_M2×4mm_K

PH_T2×6mm_K

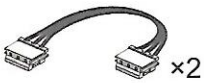
PH_M2.5×12mm_K

PH_M3×8mm_K

Rivet

Plate_Support_ M3×35mm

Ball Caster



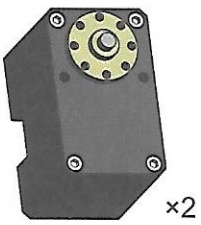
DYNAMIXEL to OpenCR Cable

NUT_M3

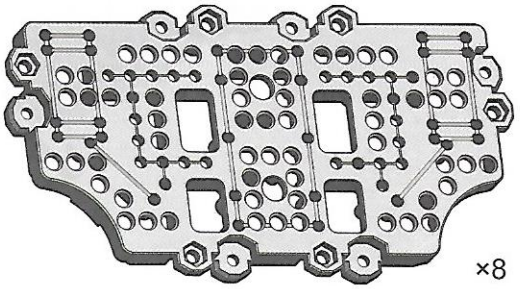
Bracket

Wheel

Tire

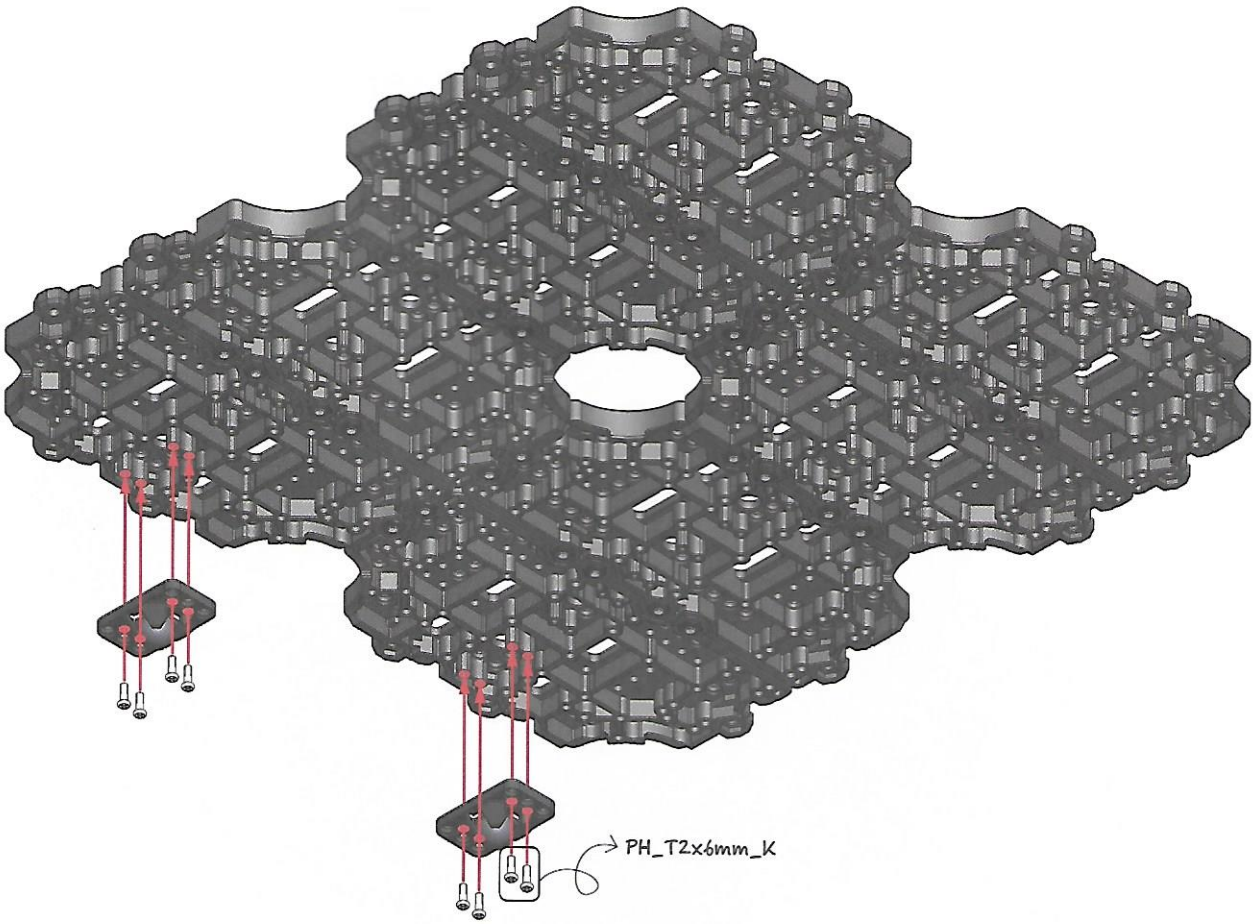


DYNAMIXEL (XM430)



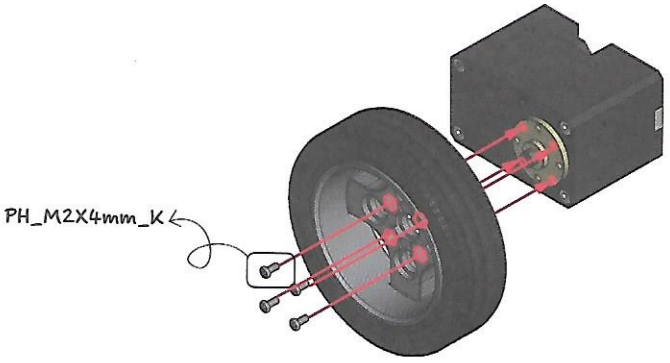
Waffle-Plate

Assemble ***Ball Casters*** from underneath the First Layer of ***Waffle-Plate***



Assemble ***Tire*** on the ***Wheel***

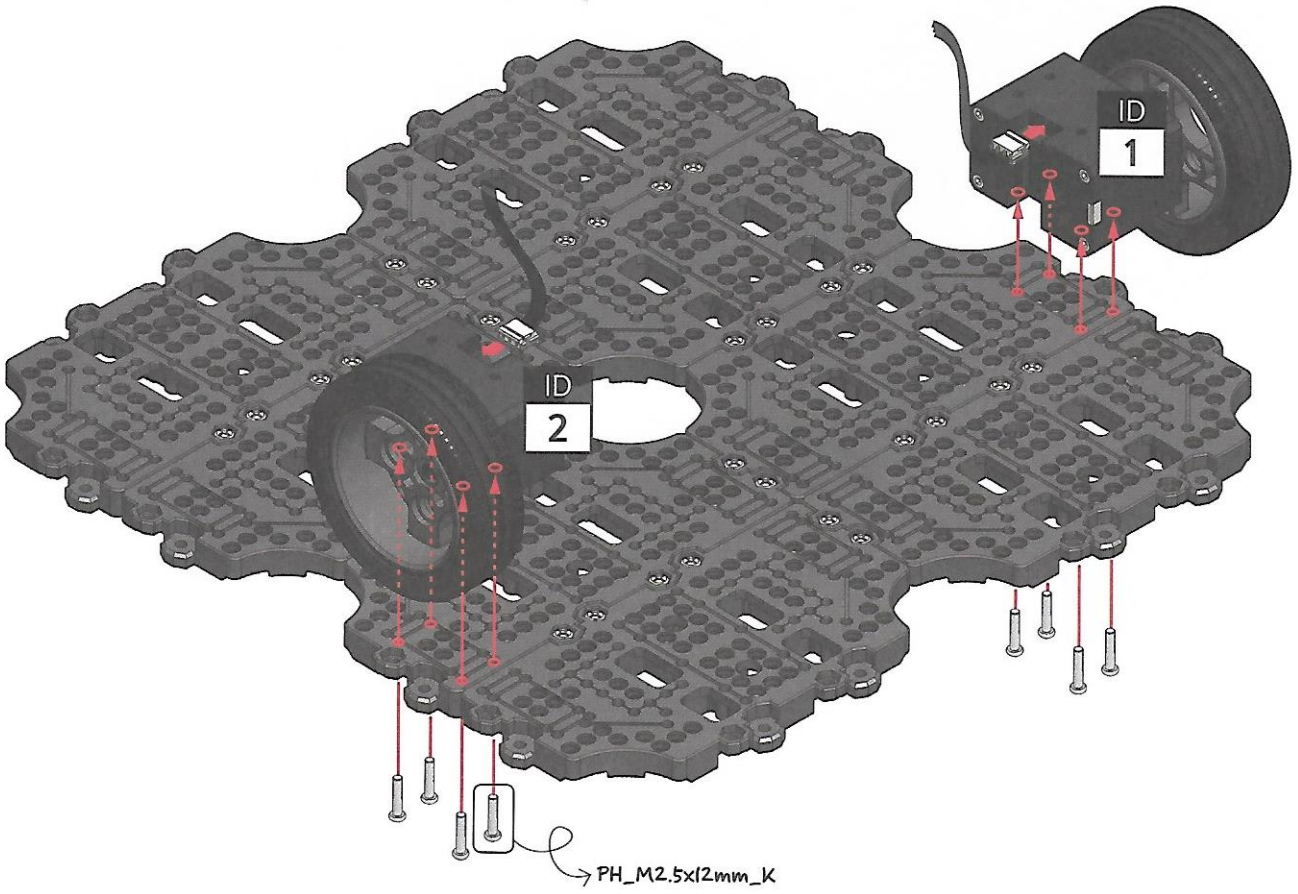
Assemble the ***Tire + Wheel*** to the ***DYNAMIXEL*** using PH screw bolts



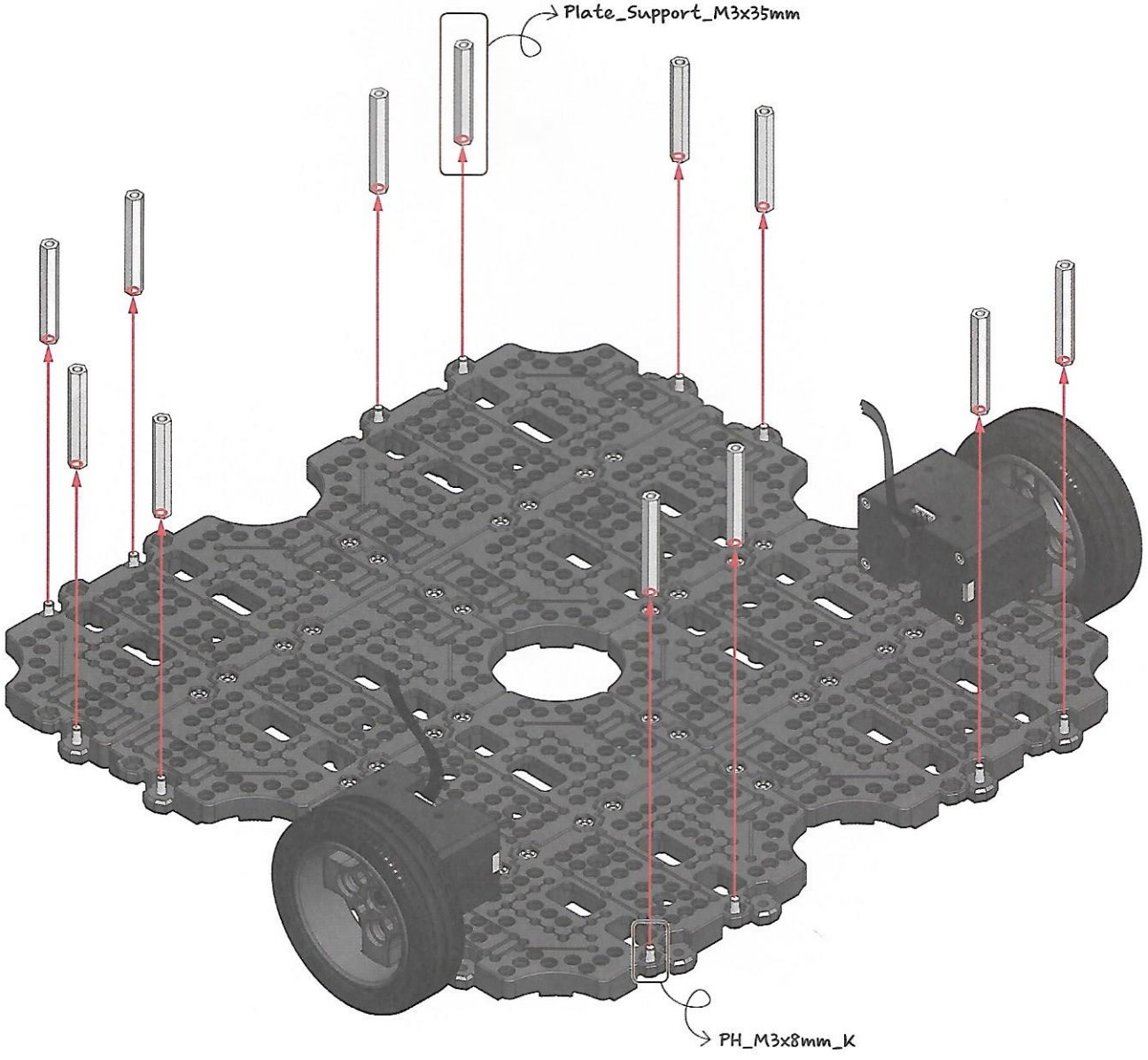
Assemble ***DYNAMIXEL*** on the First Layer of ***Waffle-Plate***

Notice the ID of ***DYNAMIXEL*** and the orientation of the ***Wheel***

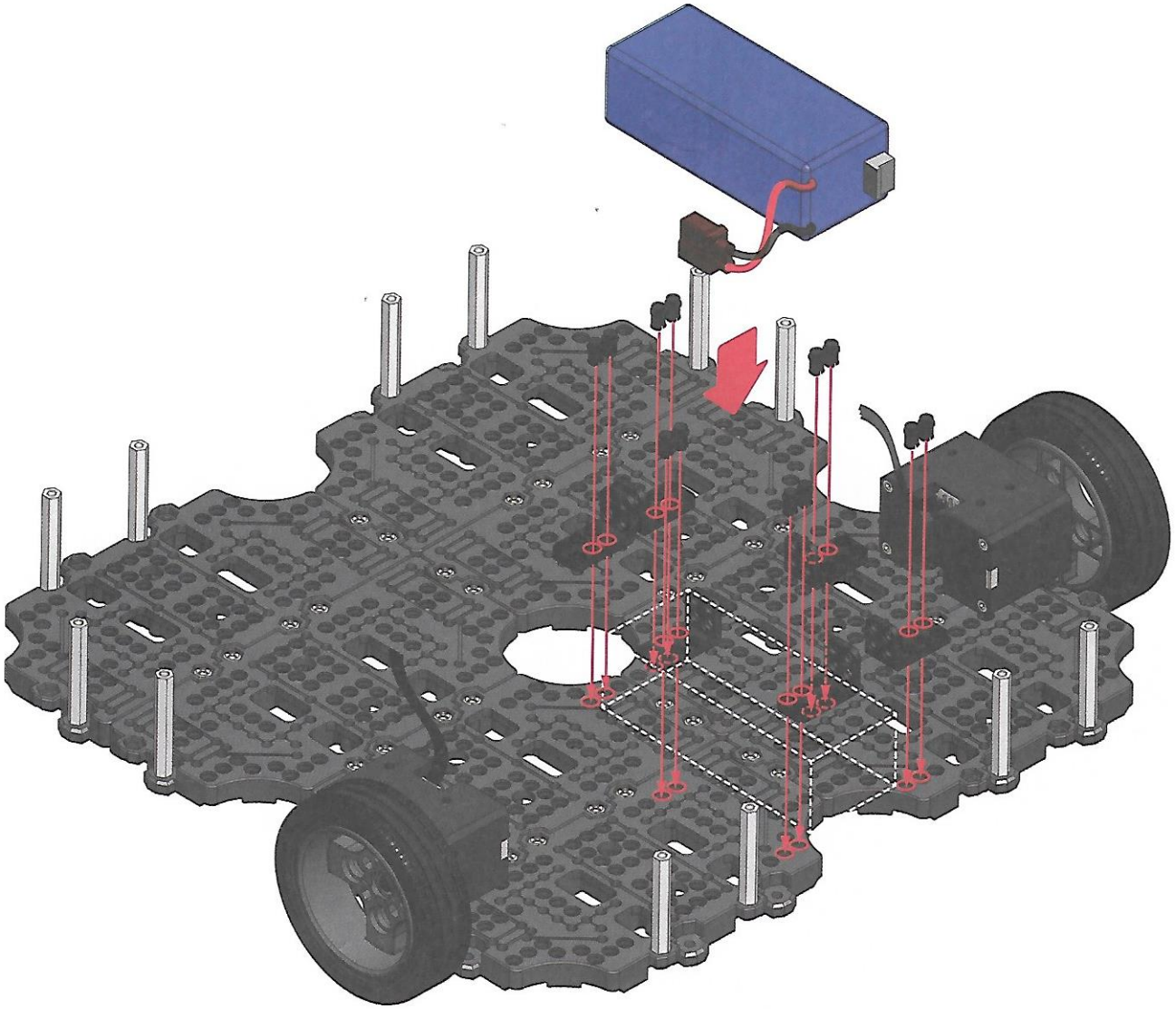
Connect ***DYNAMIXEL to OpenCR Cable*** to ***DYNAMIXEL***



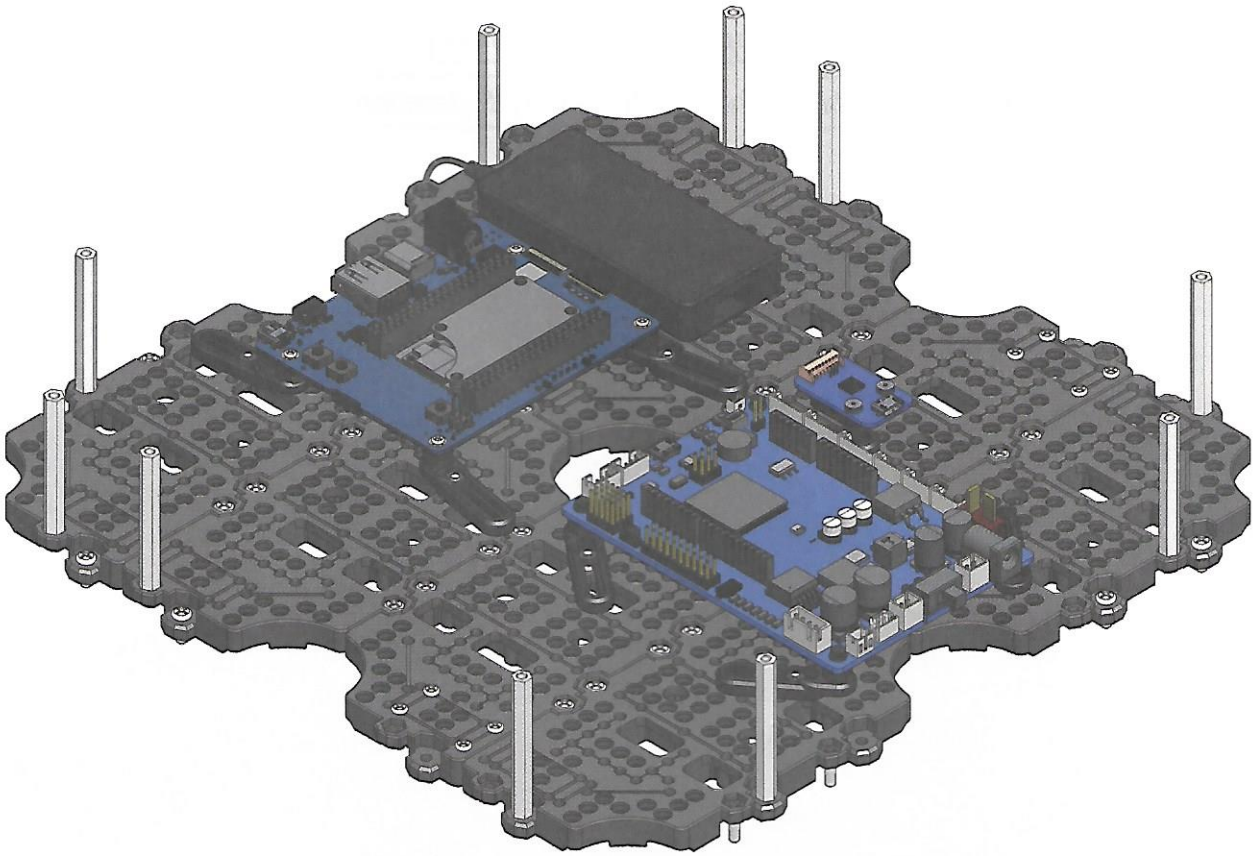
Assemble ***Plate_Supports*** using PH screw bolts

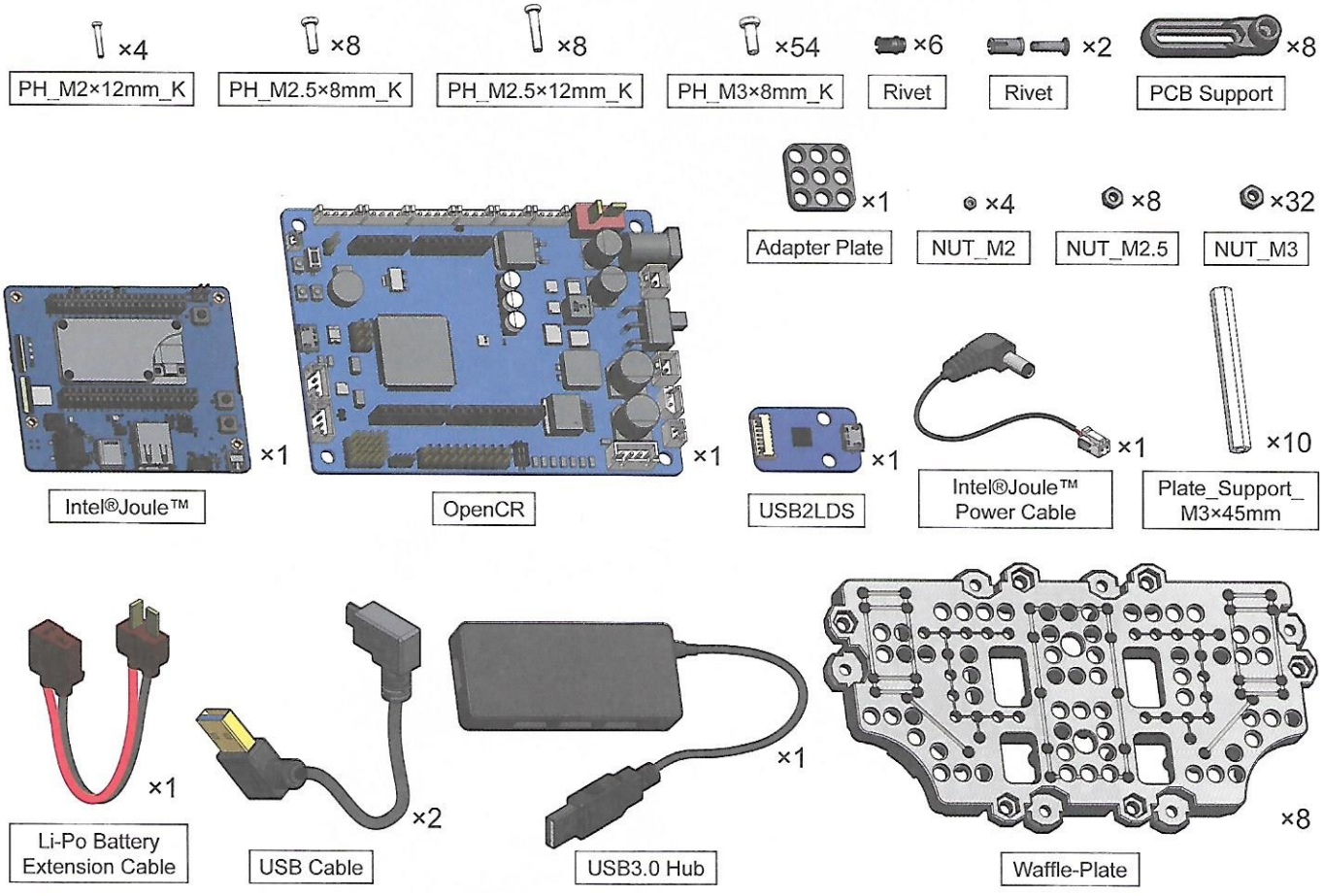


Place ***Li-Po Battery*** in between ***DYNAMIXEL***



Second Layer Assembly

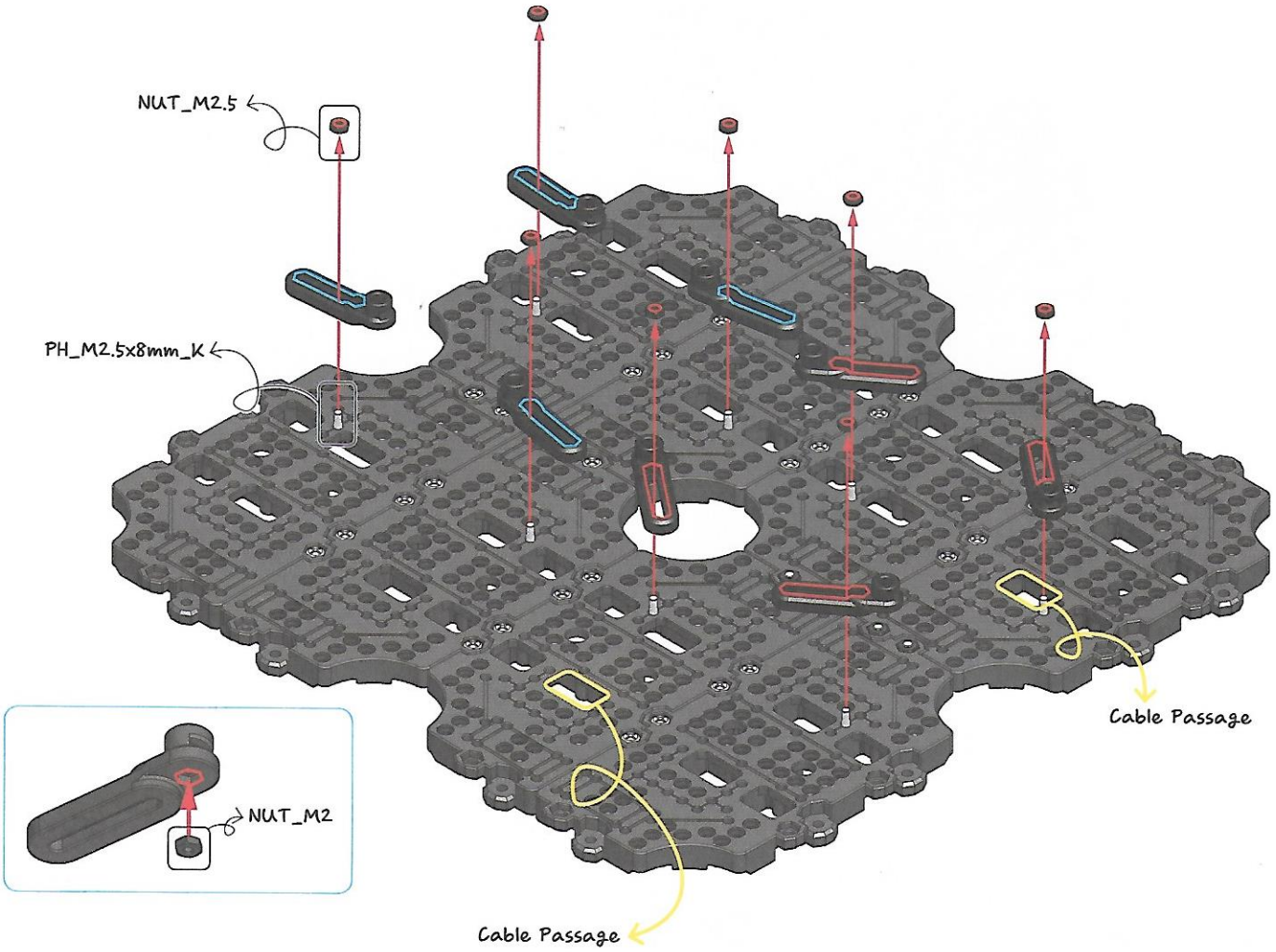




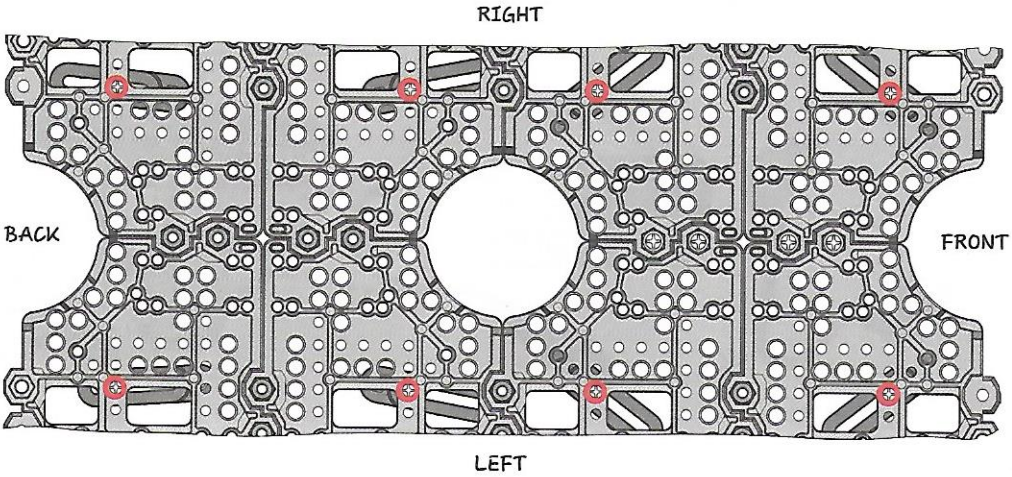
NUT_M2 should be inserted into the hexagonal hole underneath the ***PCB Supports*** for ***Intel® Joule™***

Do not insert ***NUT_M2*** in the ***PCB Supports*** for ***OpenCR***

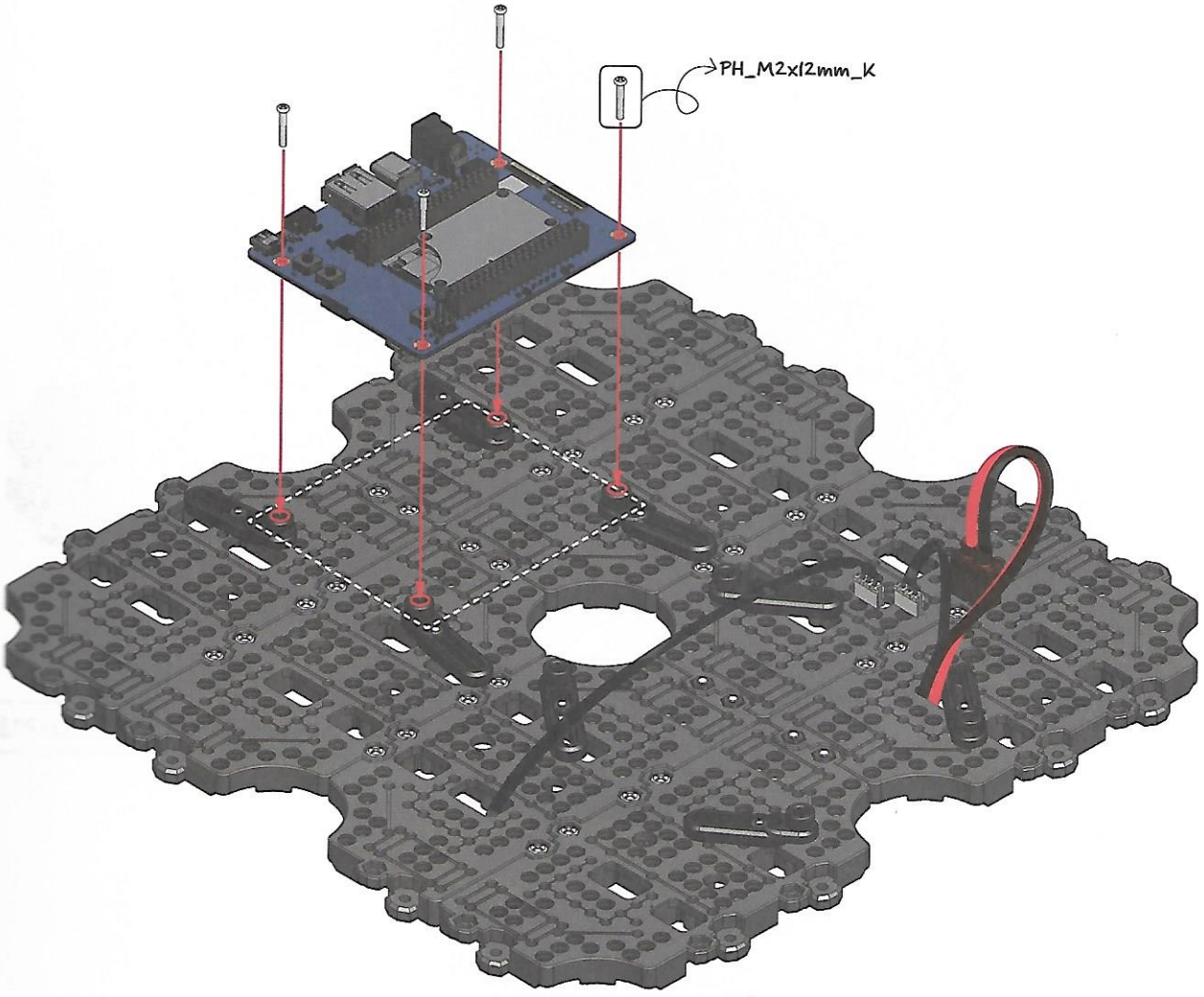
Pass ***DYNAMIXEL to OpenCR Cables*** and ***Li-Po Battery Extension Cable*** through Cable Passages



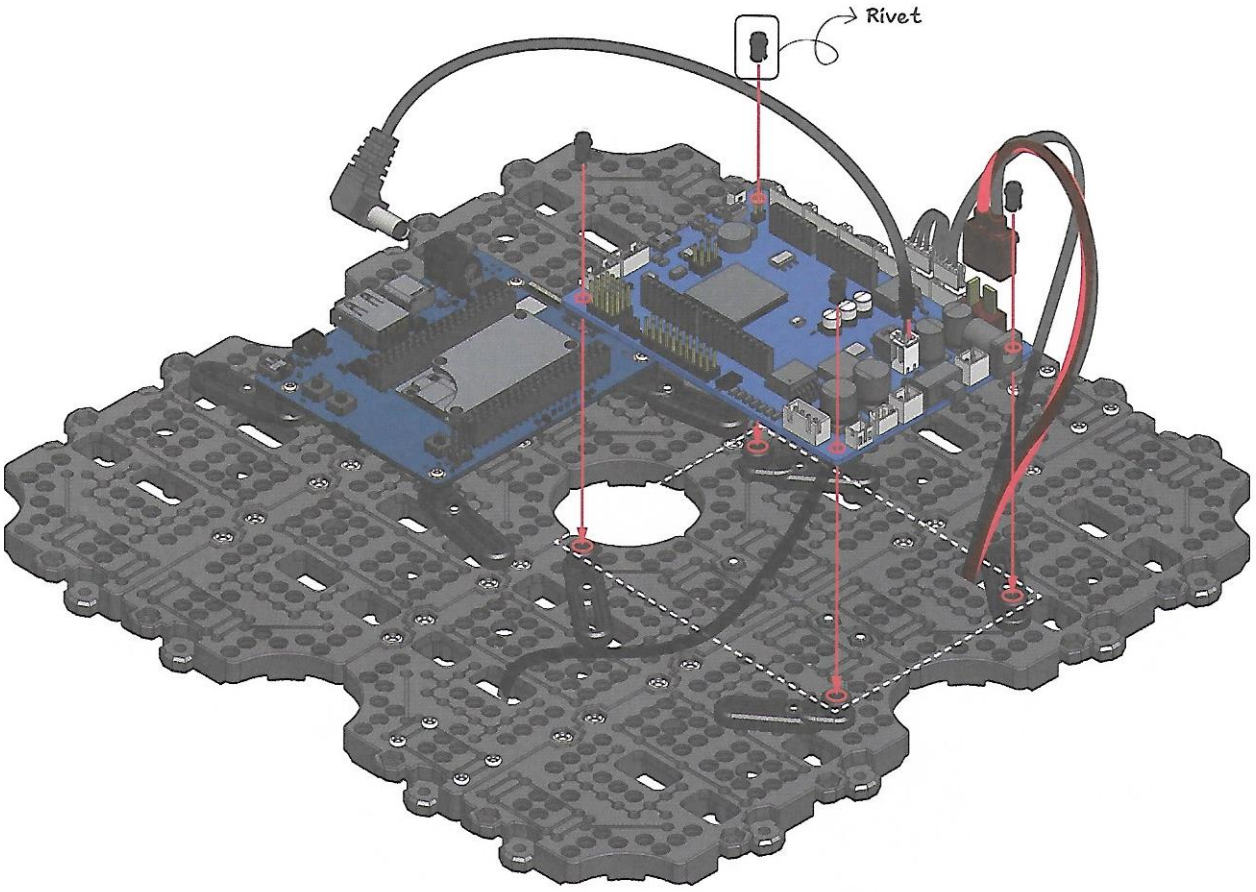
* ***PCB Support*** bolts can be assembled at below locations from underneath the Second Layer



en assembling ***Intel® Joule™***, spreading out Wi-Fi and Bluetooth antenna could improve
less communication performance.



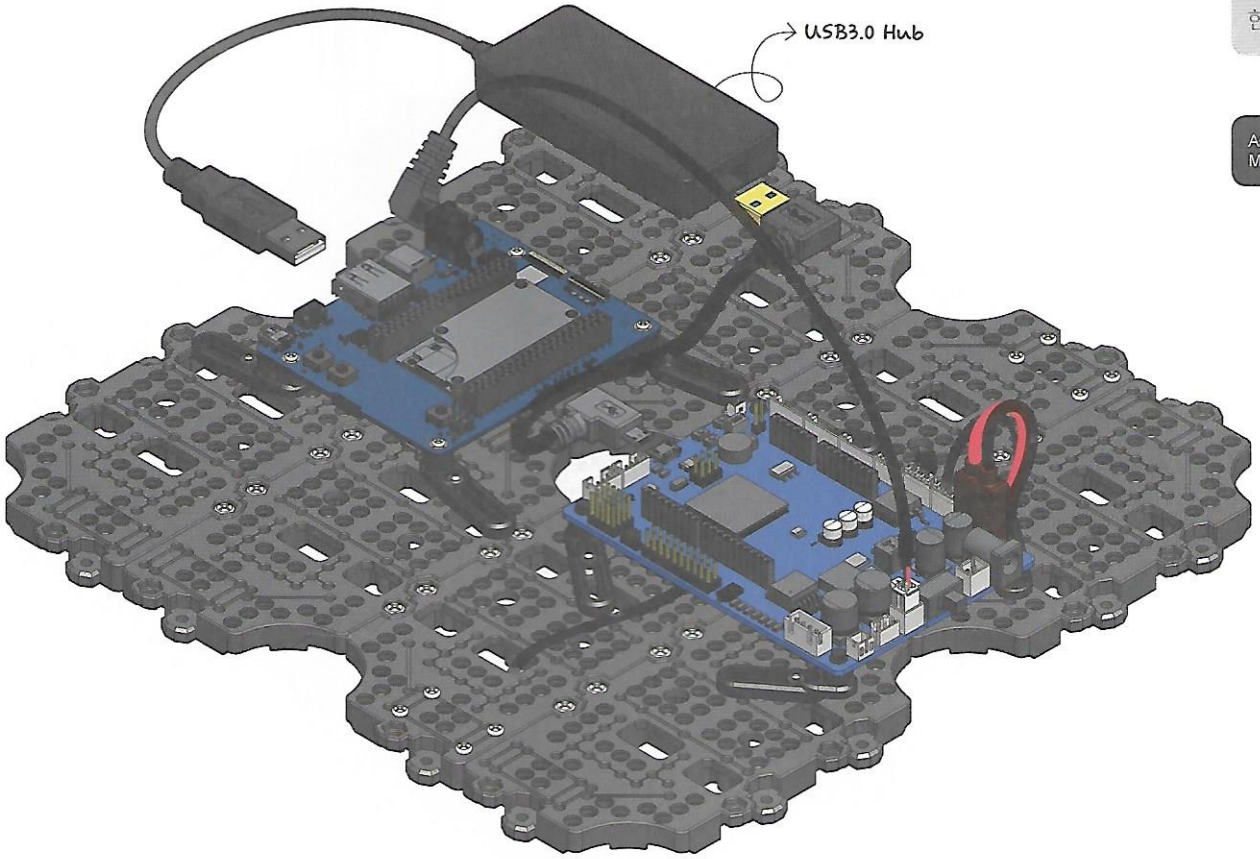
When assembling ***OpenCR***, connect ***Li-Po Battery Extension Cable***, ***DYNAMIXEL to OpenCR Cables*** and ***Intel® Joule™ Power Cable***



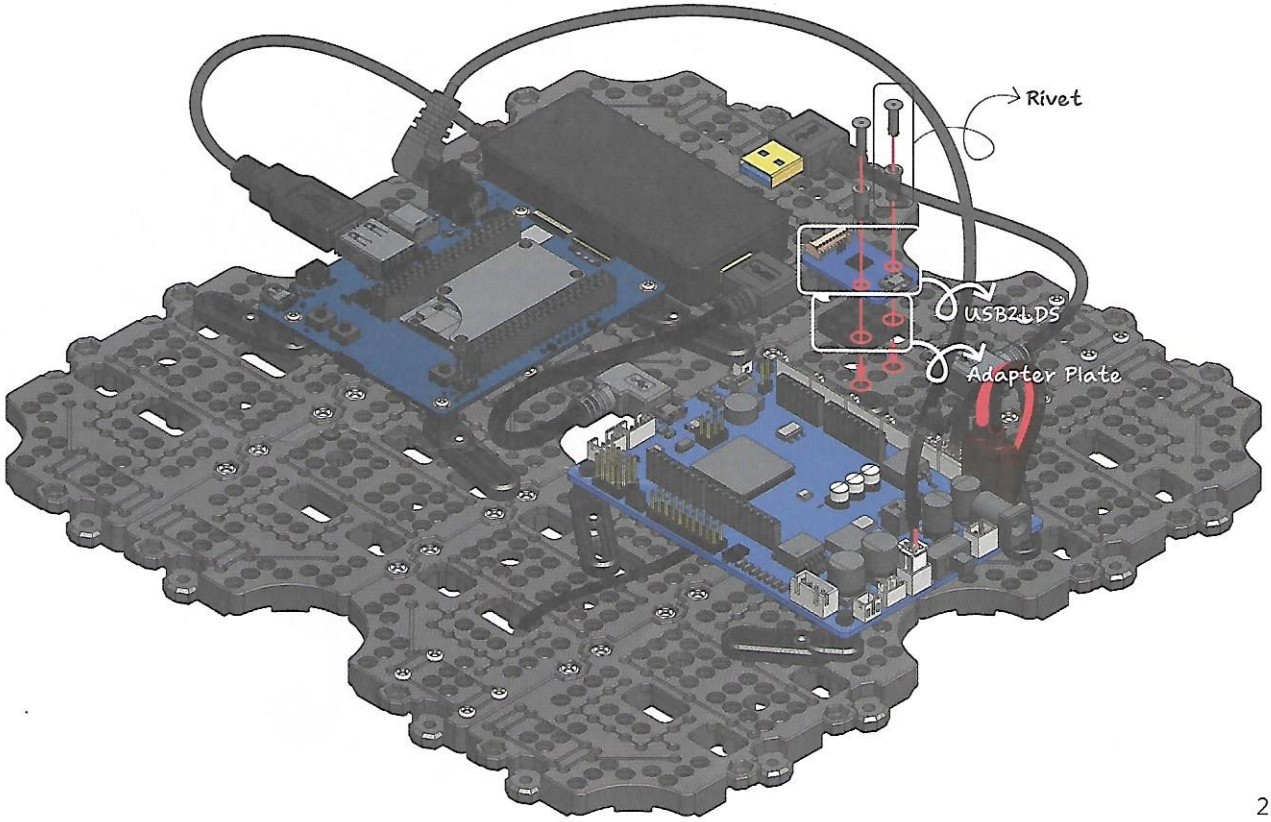
Place ***USB3.0 Hub*** on ***Waffle-Plate*** using double-sided tape.

Connect ***USB3.0 Hub*** to ***Intel® Joule™***

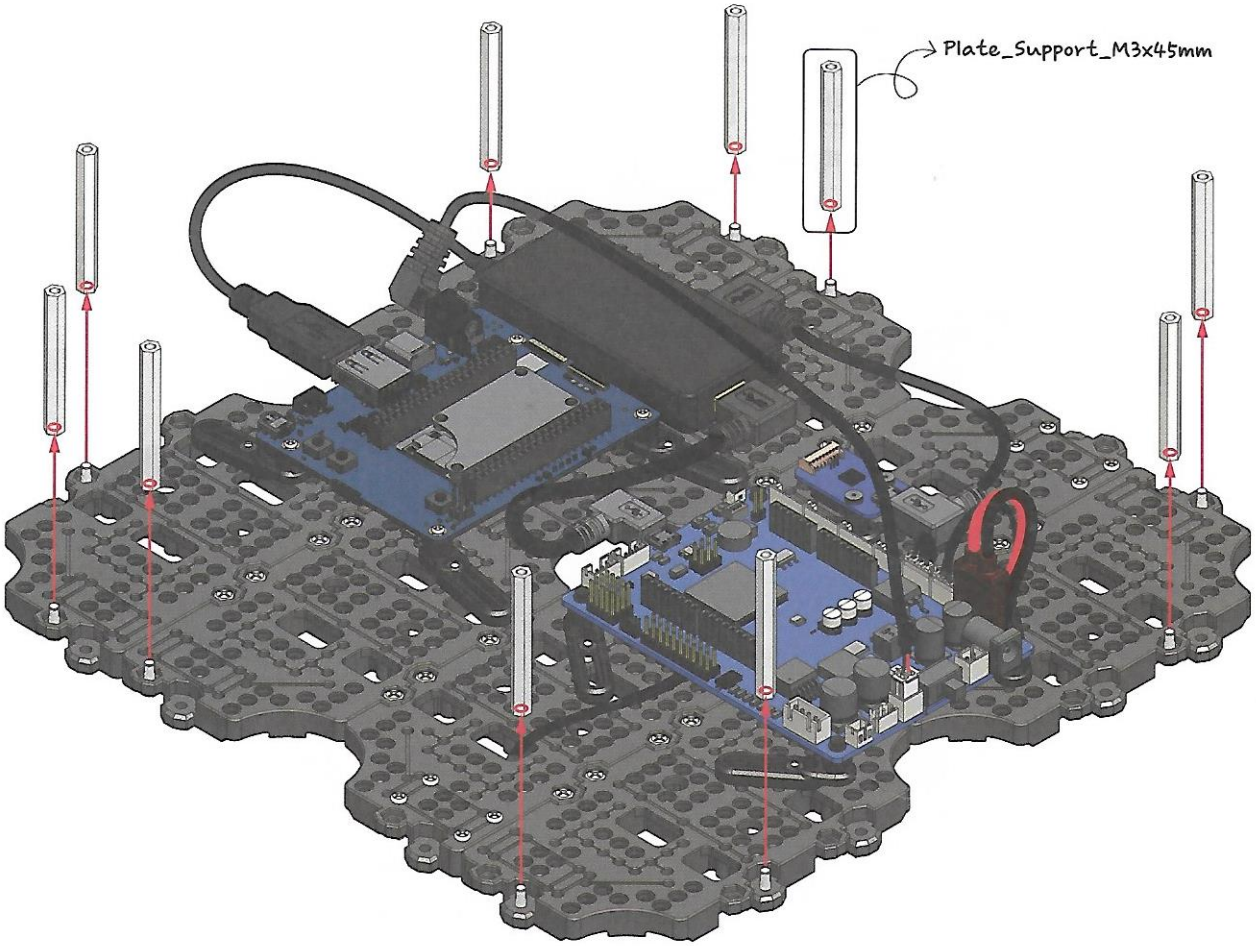
Connect ***OpenCR*** to ***USB3.0 Hub*** with ***USB Cable***



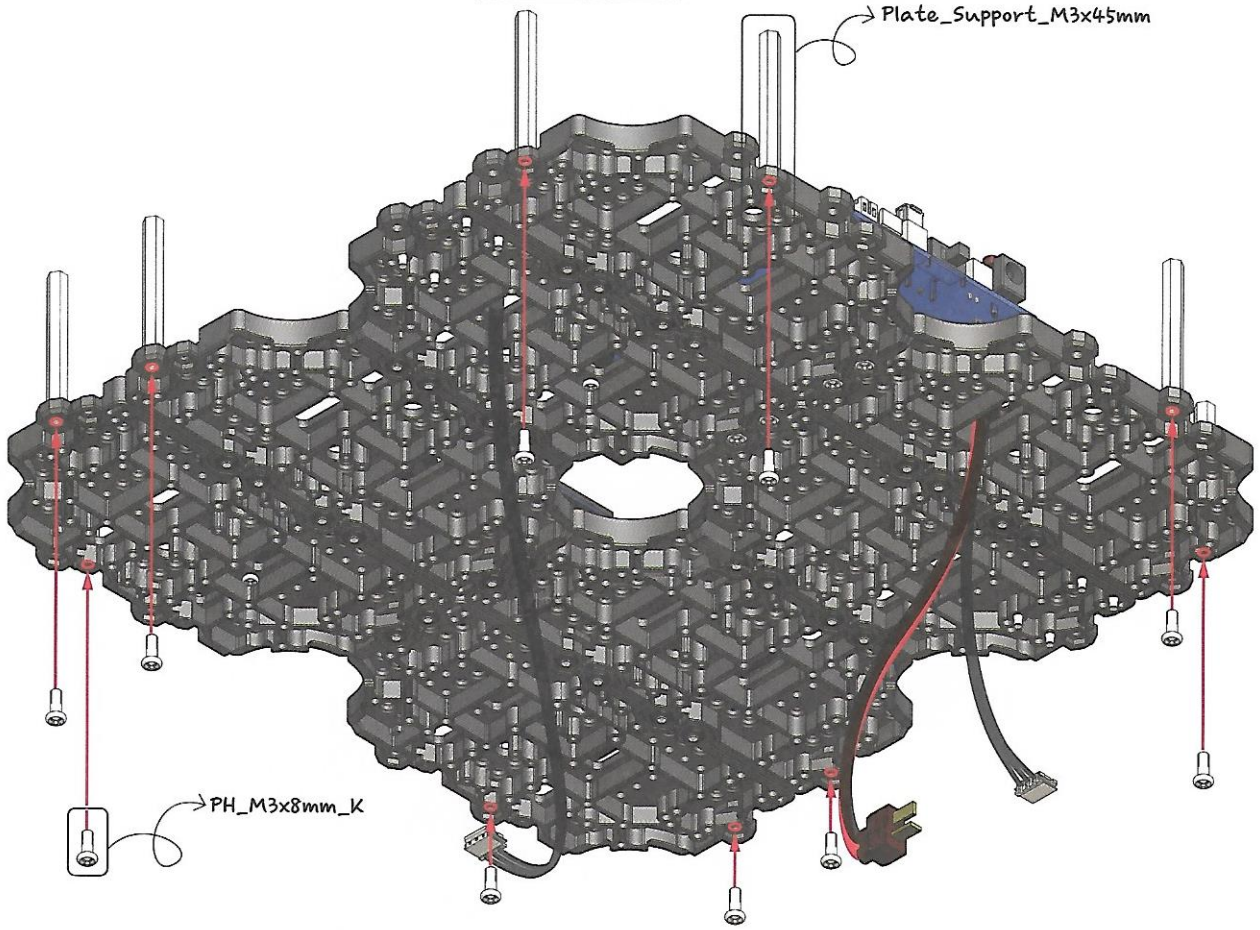
Mount ***USB2LDS*** and ***Adapter Plate*** on ***Waffle-Plate*** using ***Rivets***



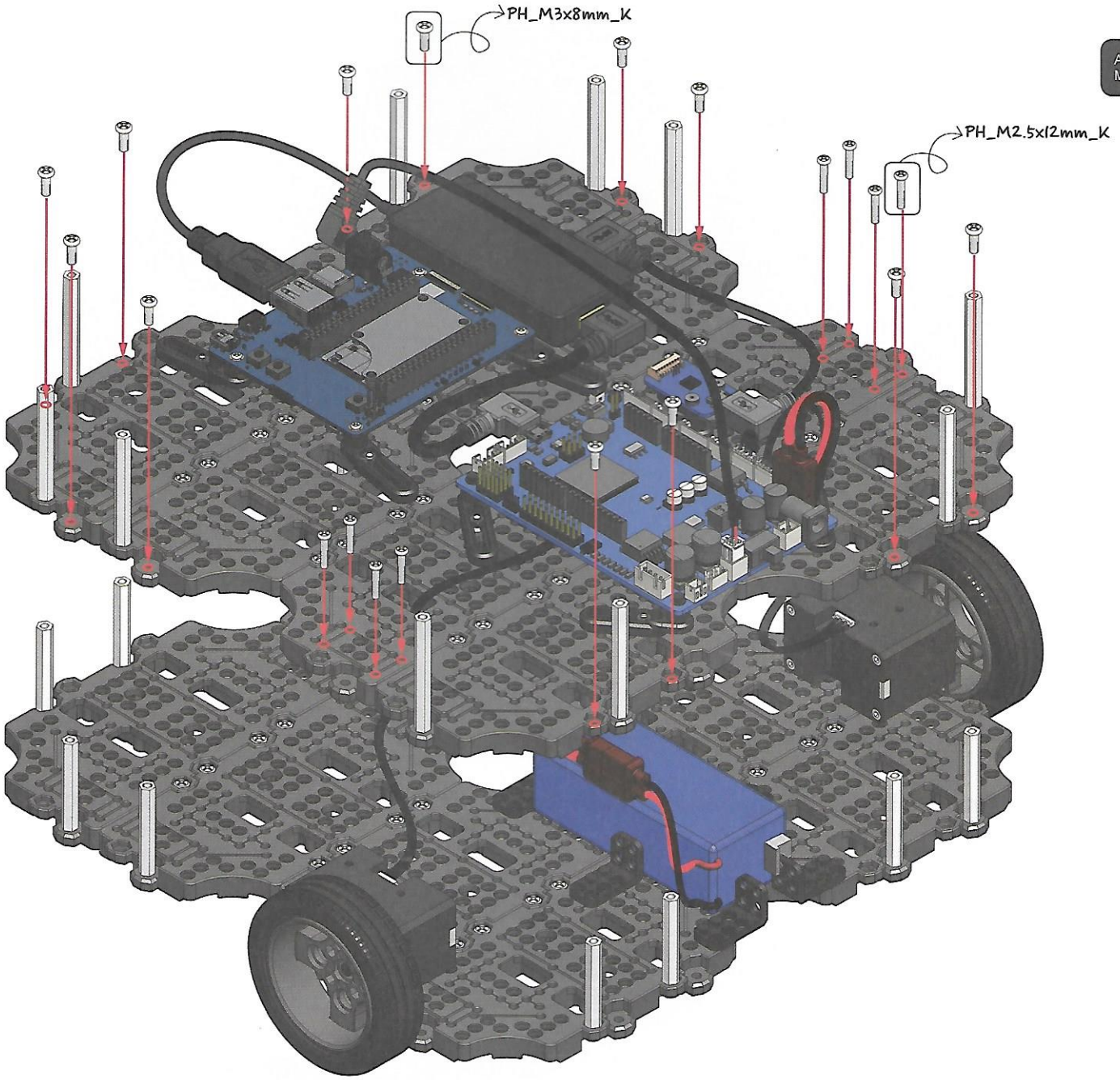
Assemble ***Plate Supports*** using ***PH_M3×8mm_K*** bolts



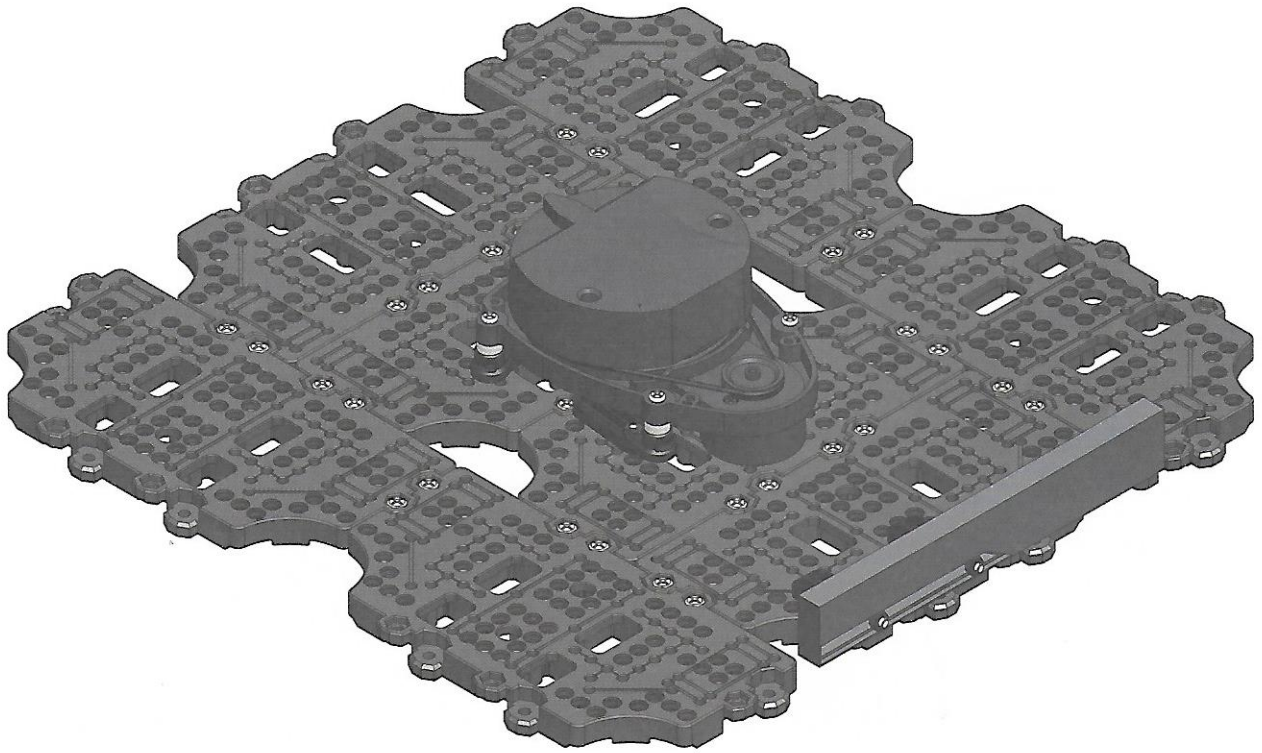
* Reference view from underneath the ***Waffle-Plate***

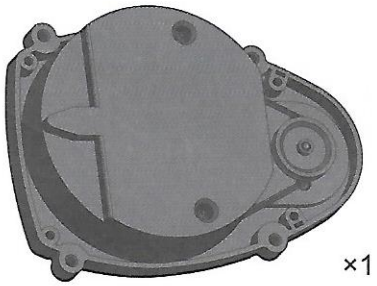


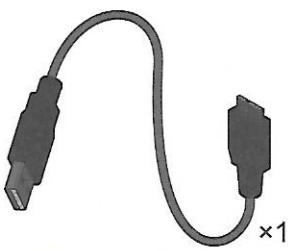
Assemble the Second Layer on top of the First Layer

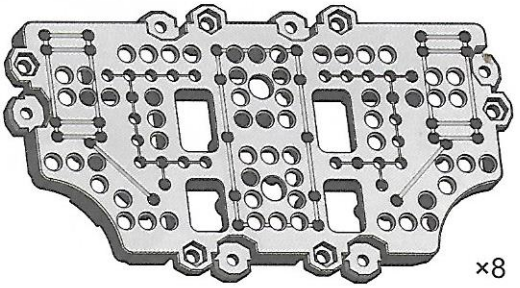


Third Layer Assembly

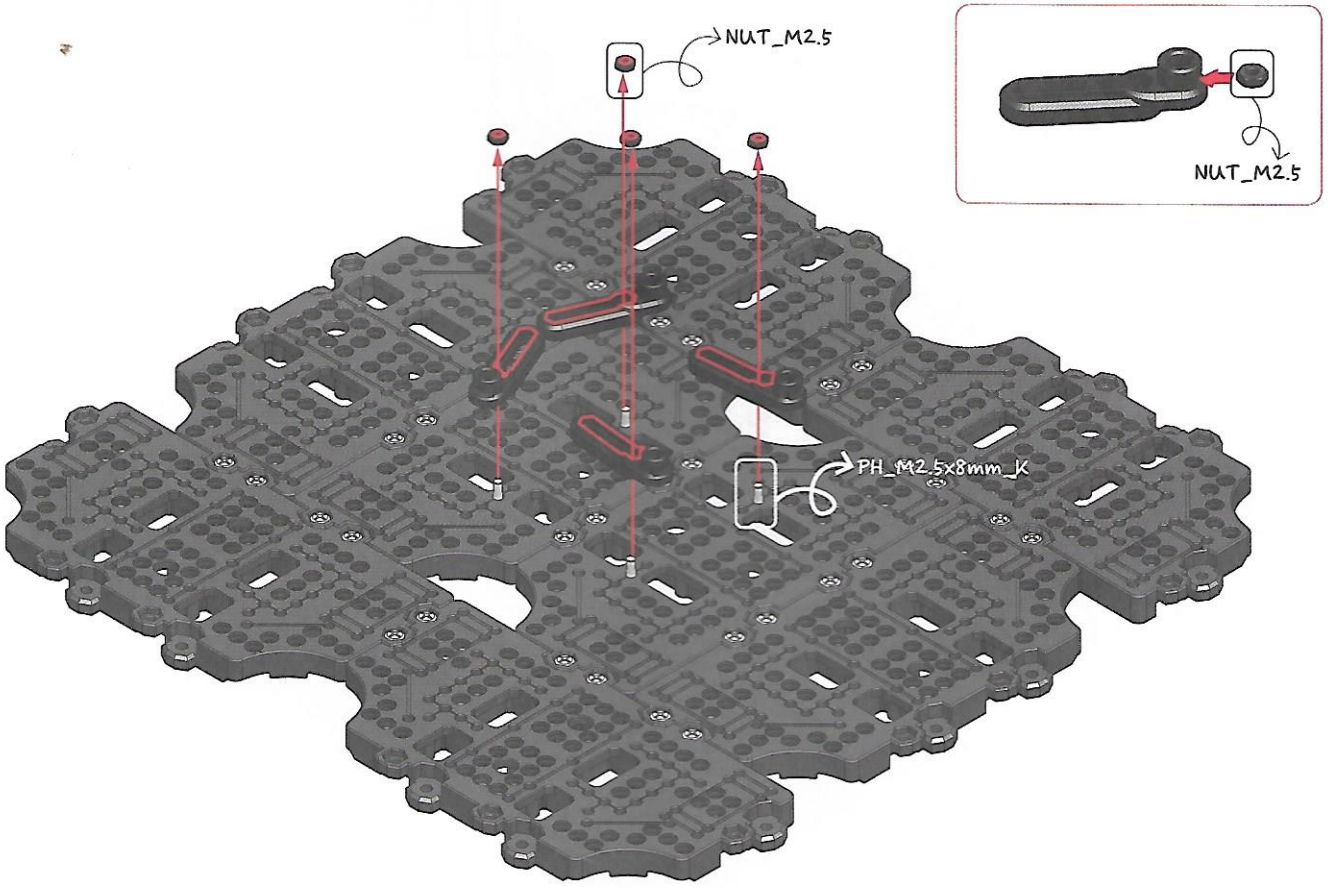




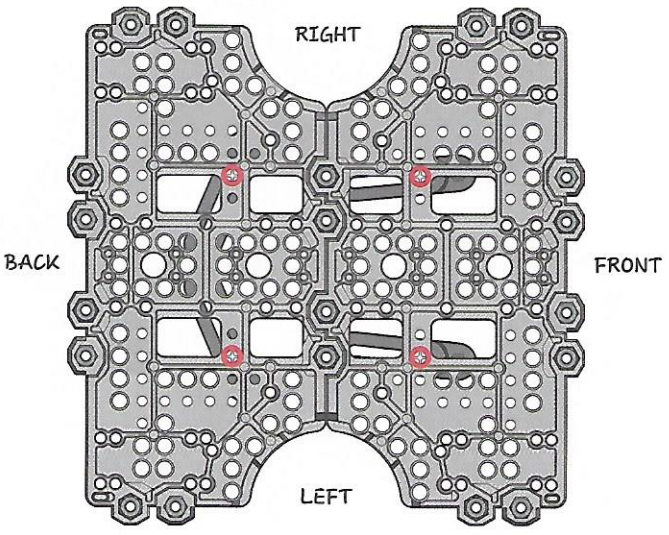




NUT_M2.5 should be inserted into the slot of the **PCB Supports** for **HLS-LFCD2**

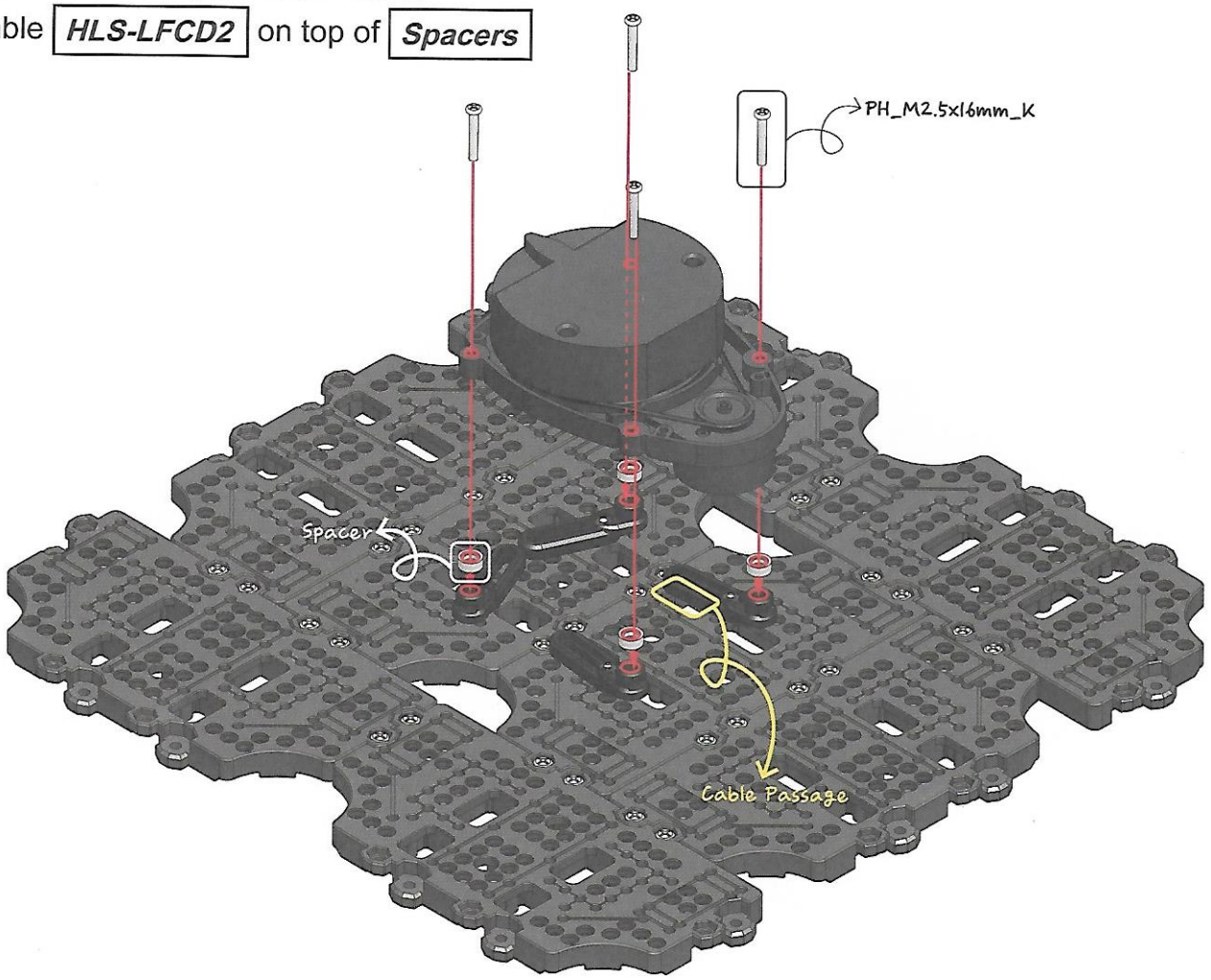


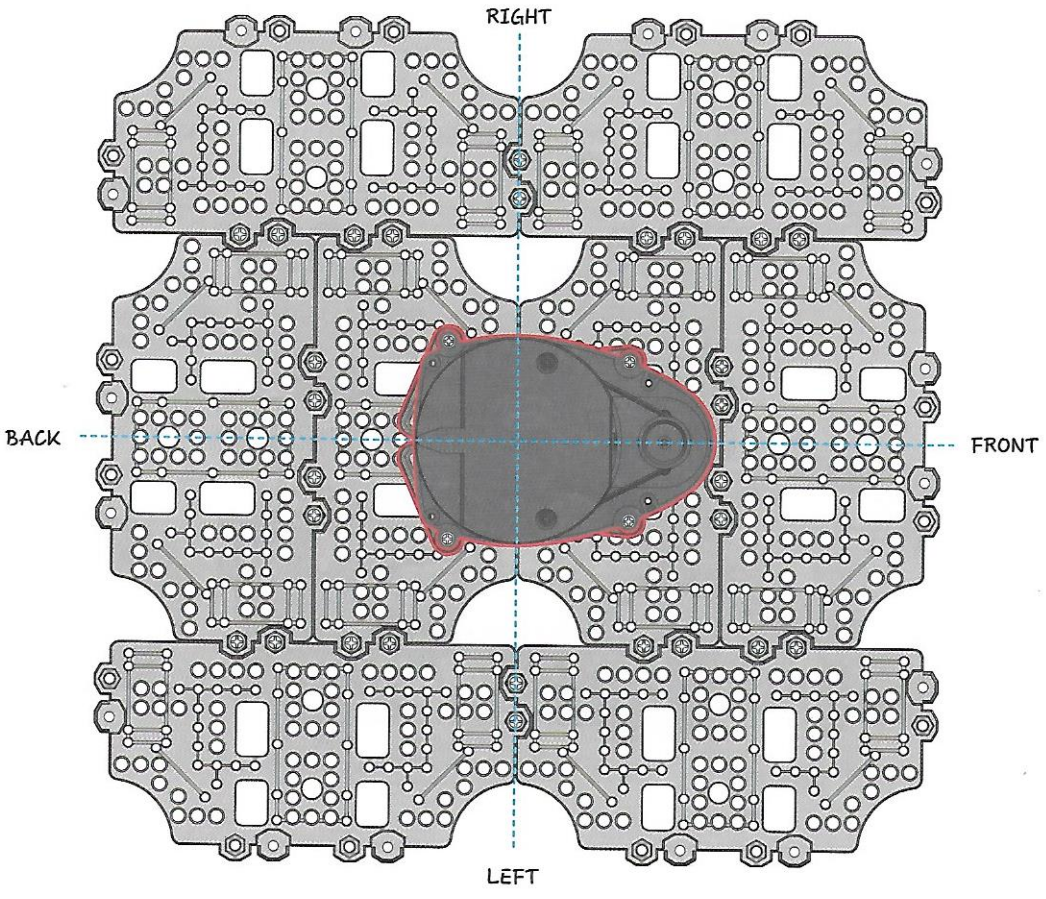
PCB Support bolts can be assembled at below locations from underneath the Third Layer



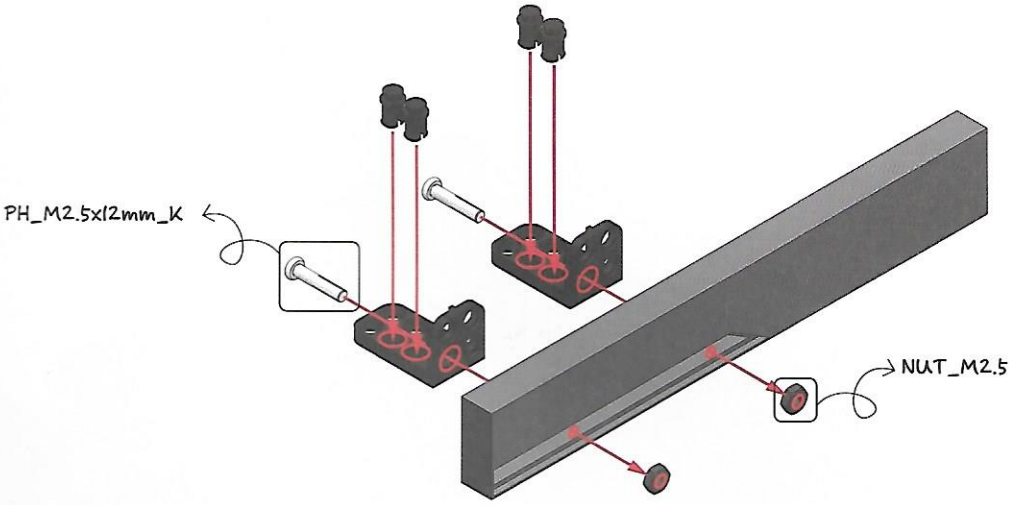
Place ***Spacers*** on ***PCB Supports***

Assemble ***HLS-LFCD2*** on top of ***Spacers***



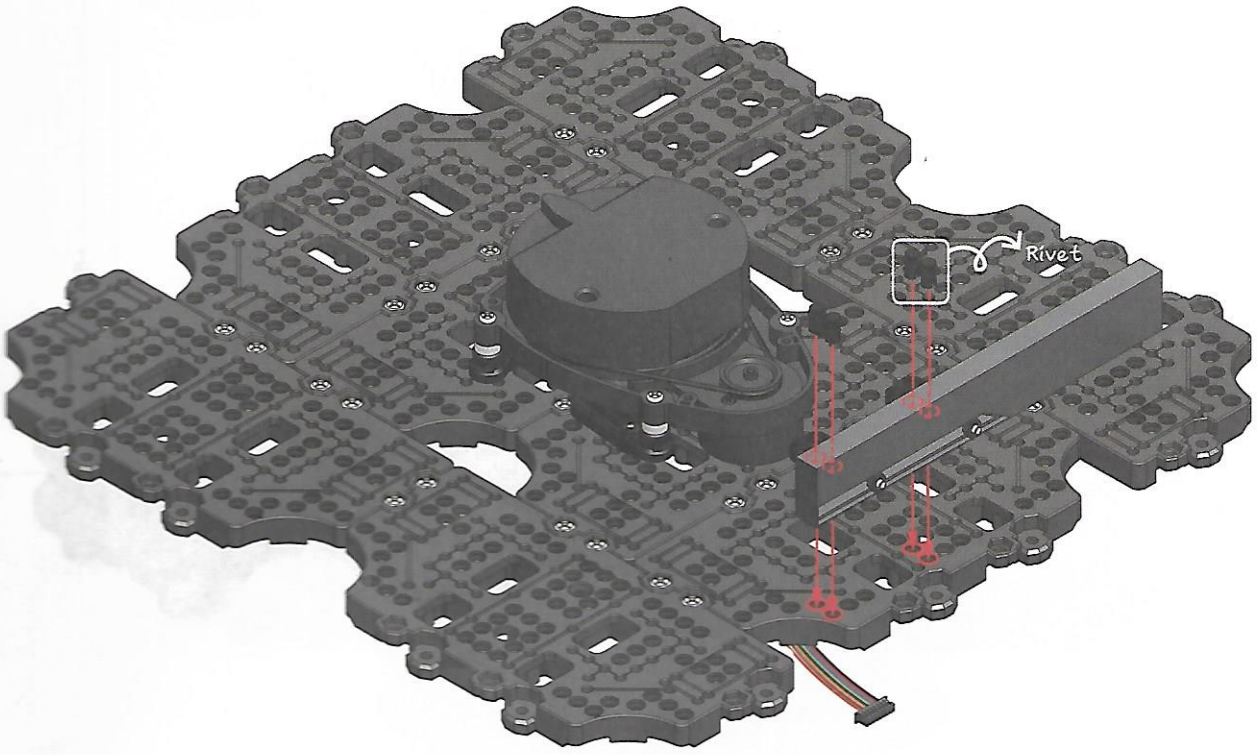


Assemble ***Brackets*** to ***Intel® RealSense™ R200***



Mount ***Intel® RealSense™ R200***

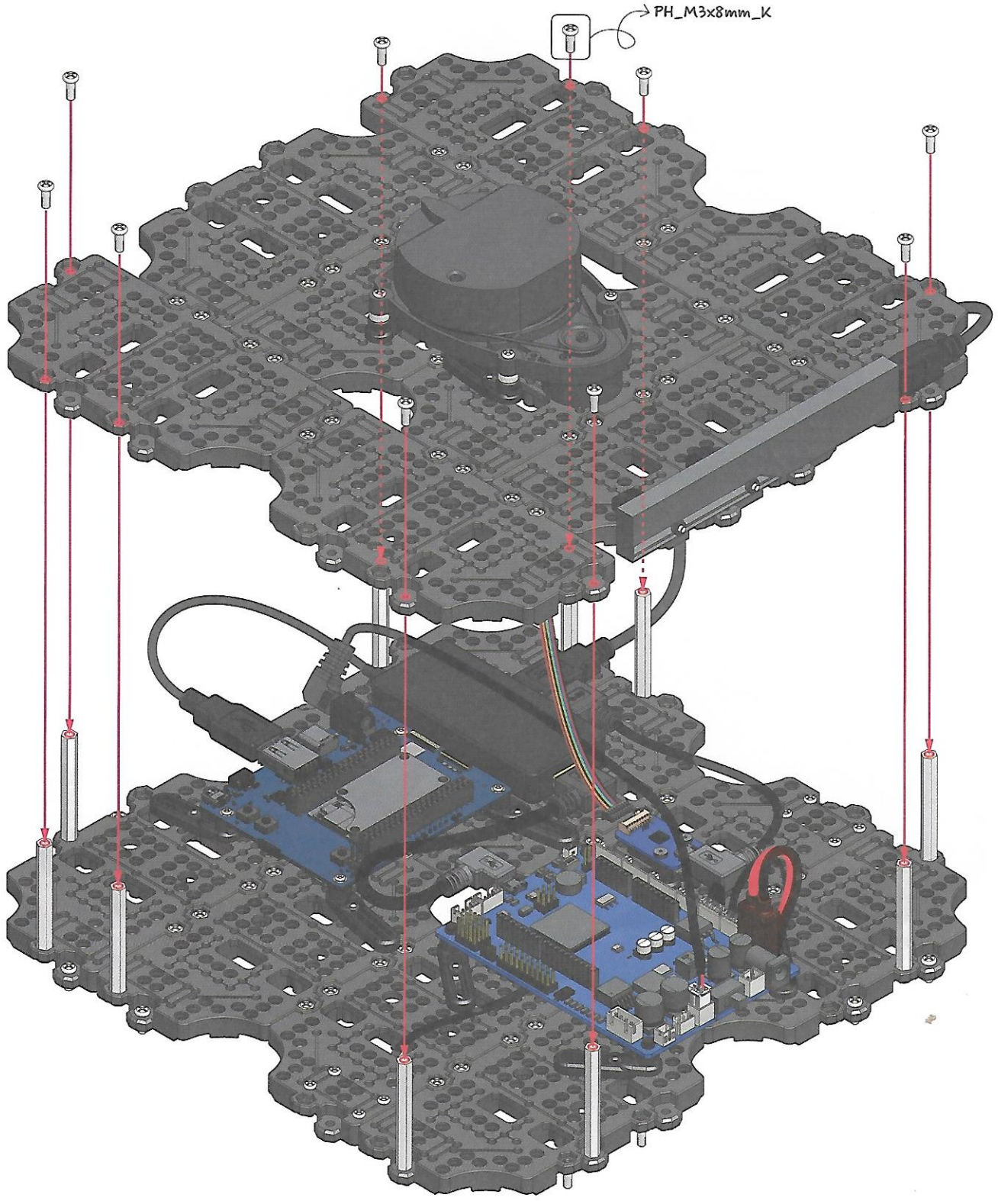
Connect ***USB 3.0 Type A to Micro-B 10 Pin Cable*** to ***Intel® RealSense™ R200***

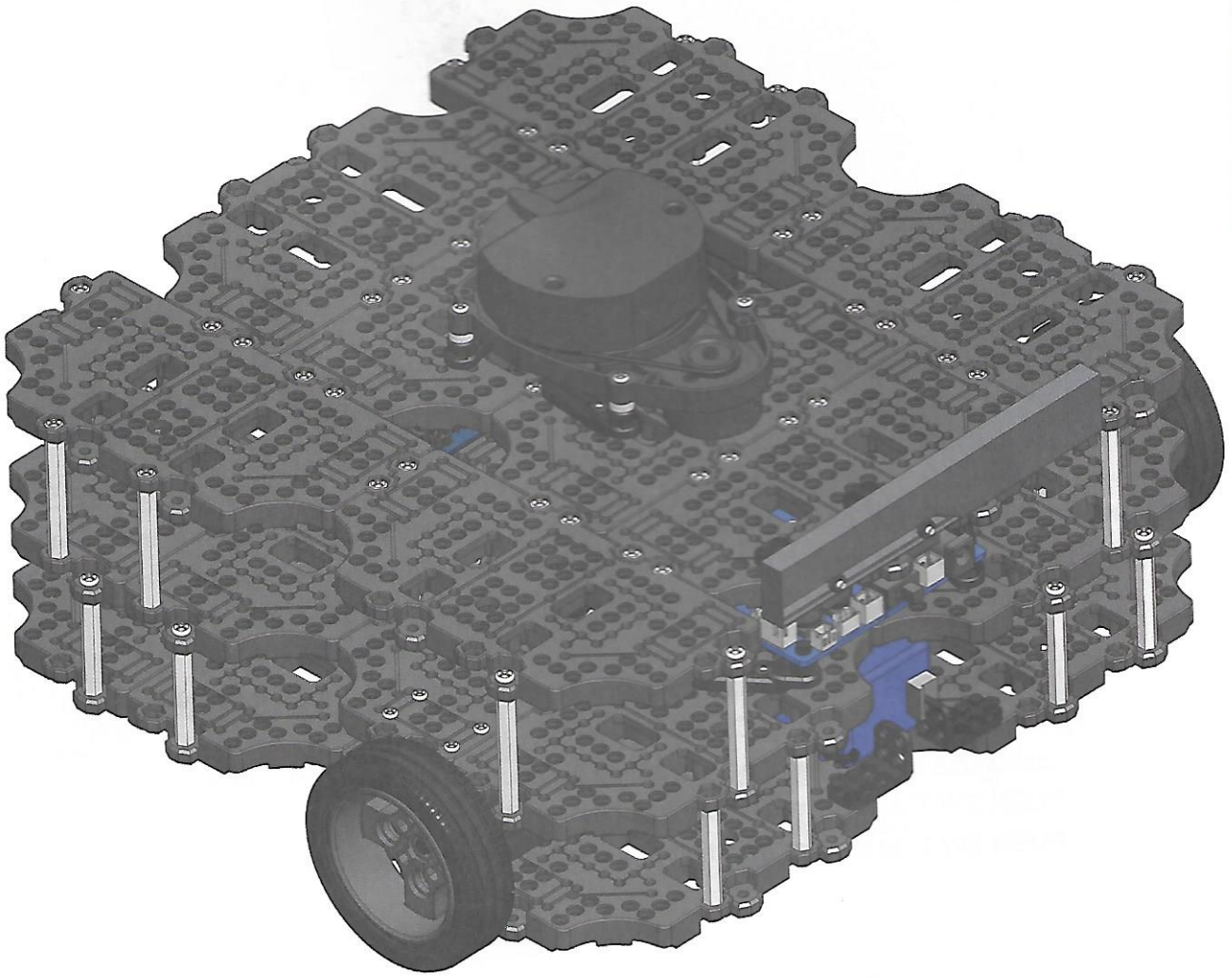


Connect ***HLS-LFCD2*** to ***USB2LDS***

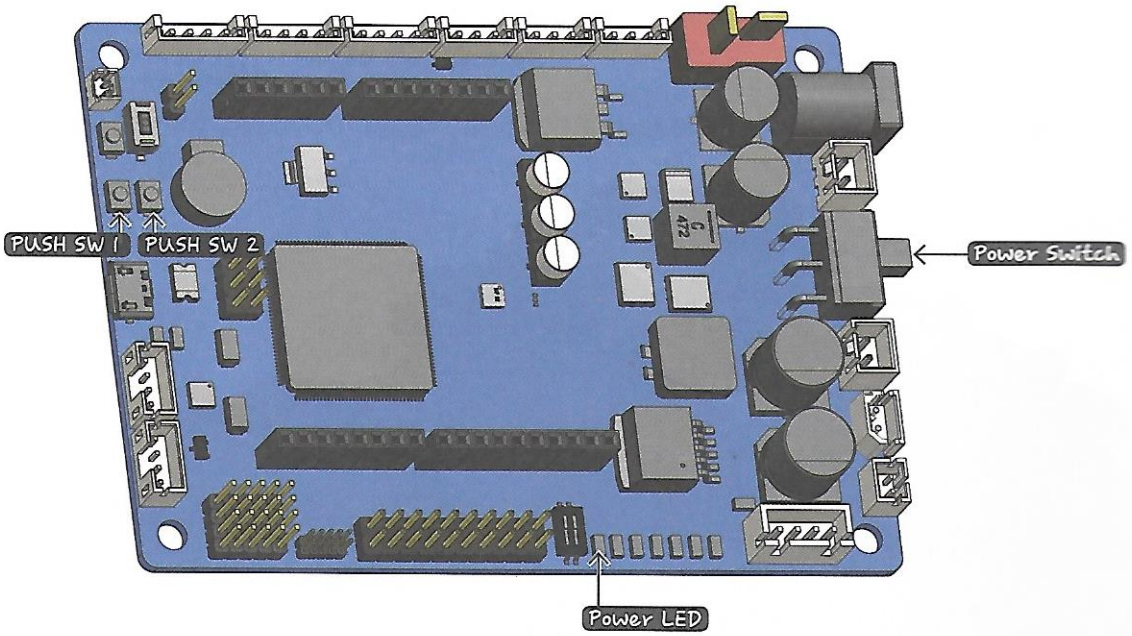
Connect ***Intel(R) RealSense™ R200*** to ***USB3.0 Hub*** with ***USB 3.0 Type A to Micro-B 10 Pin Cable***

Assemble the Third Layer on top of the Second Layer





4 Basic Operations



You can use the “PUSH SW 1” and “PUSH SW 2” buttons to see whether your robot has been properly assembled. This process tests the left and right DYNAMIXEL and the OpenCR board. Please check the manual of “turtlebot3.robotis.com” to confirm operation of SBC (Single Board Computer) and sensors.

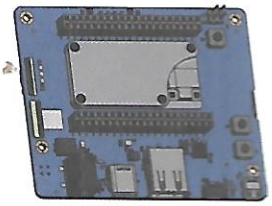
(1) After assembling, connect the battery to the OpenCR board and turn on the "Power Switch". You can see that the "Power LED" of OpenCR turns on.
(2) Place the robot on the floor. At this time, the safety distance should be 1 meter on each side.
(3) Press the "PUSH SW 1" to confirm that the robot moves 30 centimeters forward.
(4) Press the "PUSH SW 2" to confirm that the robot rotates 180 degrees in place.

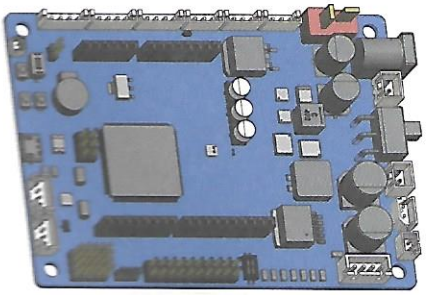
5 More Information

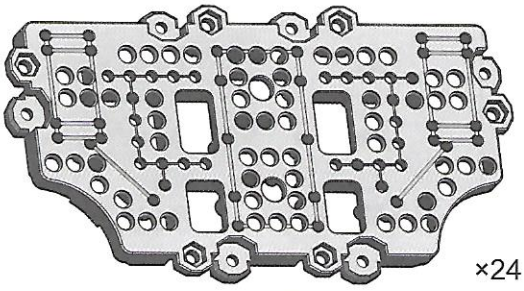
For more information please refer to our TurtleBot and TurtleBot3 websites.

TurtleBot Brand Page	TurtleBot3 Wiki Page
http://www.turtlebot.com	http://turtlebot3.robotis.com

Parts List

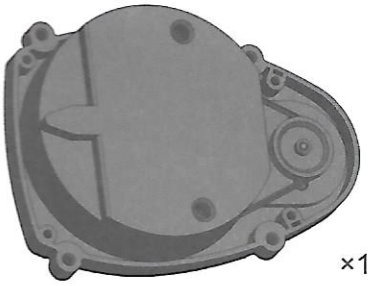

×1
Intel®Joule™

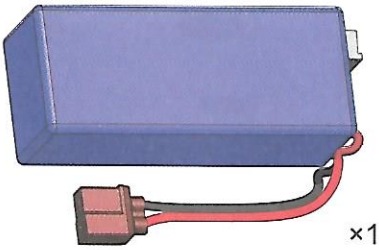

×1
OpenCR


×24
Waffle-Plate

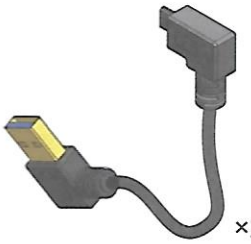
×2
Wheel

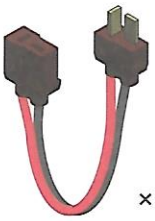
×2
Tire

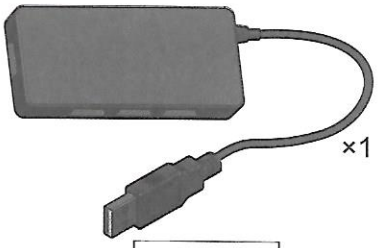

×1
HLS-LFCD2

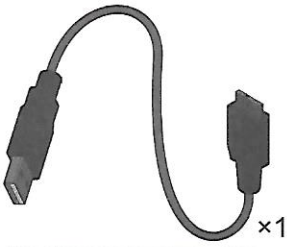

×1
Li-Po Battery

×2
DYNAMIXEL (XM430)

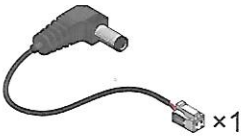

×2
USB Cable


×1
Li-Po Battery Extension Cable


×1
USB3.0 Hub


×1
USB 3.0 Type A to Micro-B 10 Pin Cable

×1
Intel® RealSense™R200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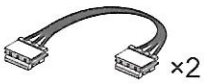
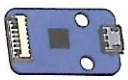
Intel®Joule™ Power Cable


×2
DYNAMIXEL to OpenCR Cable

×2
Ball Caster


×1
USB2LDS

×12
PCB Support

×8
Bracket

×1
Adapter Plate

×10
Rivet

×2
Rivet

×4
Spacer

×4
NUT_M2

×18
NUT_M2.5

×96
NUT_M3

×12
Plate_Support_ M3×35mm

×10
Plate_Support_ M3×45mm

×8
PH_M2×4mm_K

×8
PH_T2×6mm_K

×4
PH_M2×12mm_K

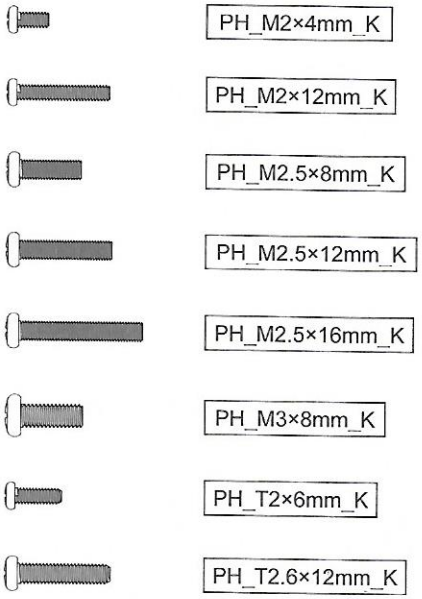
×12
PH_M2.5×8mm_K

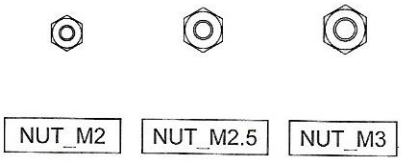
×18
PH_M2.5×12mm_K

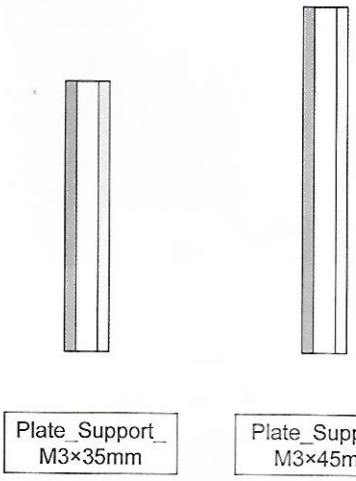
×4
PH_M2.5×16mm_K

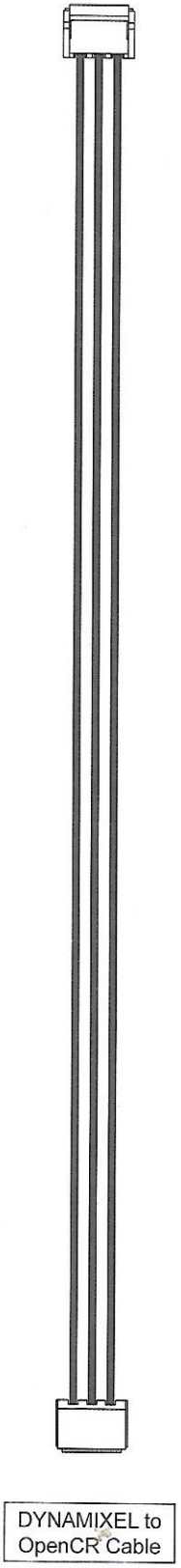
×140
PH_M3×8mm_K

1:1 scale


PH_M2×4mm_K
PH_M2×12mm_K
PH_M2.5×8mm_K
PH_M2.5×12mm_K
PH_M2.5×16mm_K
PH_M3×8mm_K
PH_T2×6mm_K
PH_T2.6×12mm_K


NUT_M2
NUT_M2.5
NUT_M3


Plate_Support_
M3×35mm
Plate_Support_
M3×45mm


DYNAMIXEL to
OpenCR Cable

TURTLEBOT3 Waffle

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