

smorphi<sup>2</sup>  
transforming learning with  
transformer robots

assembly & info



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# ( part list )



All colors of parts are represented accurately here.  
In the assembly steps, colors of some parts will be changed for diagram clarity.

4 x Acrylic Base Plate



2 x Solenoid Catch



16 x Hex M-F M3 Nylon 45mm



2 x Aluminium Base Plate



2 x Hinge Mount



100 x Cap Screw M3x5



4 x Base Skirt Panel A



1 x Hinge Mechanism



30 x Cap Screw M3x25



4 x Base Skirt Panel B



1 x Battery



5 x Countersunk Screw M4x8



4 x Mecanum Wheel (Right)



2 x Battery bracket



2 x Wing Screw M3x5



4 x Mecanum Wheel (Left)



1 x Masterboard (ESP32)



1 x USB Cable



8 x Mecanum Motor



2 x Slaveboard



6 x 4-pin Connector



8 x Motor Shaft Sleeve



1 x Sound Sensor



2 x 8-pin Connector



8 x Motor Mount



1 x Temperature Sensor



1 x Battery Charger



2 x Solenoid



3 x IR Sensor



1 x Ceramic Screwdriver CD-25



2 x Solenoid Latch Mount



6 x Sensor Lock



1 x HEX Key 1.5mm



2 x Solenoid Latch Guide

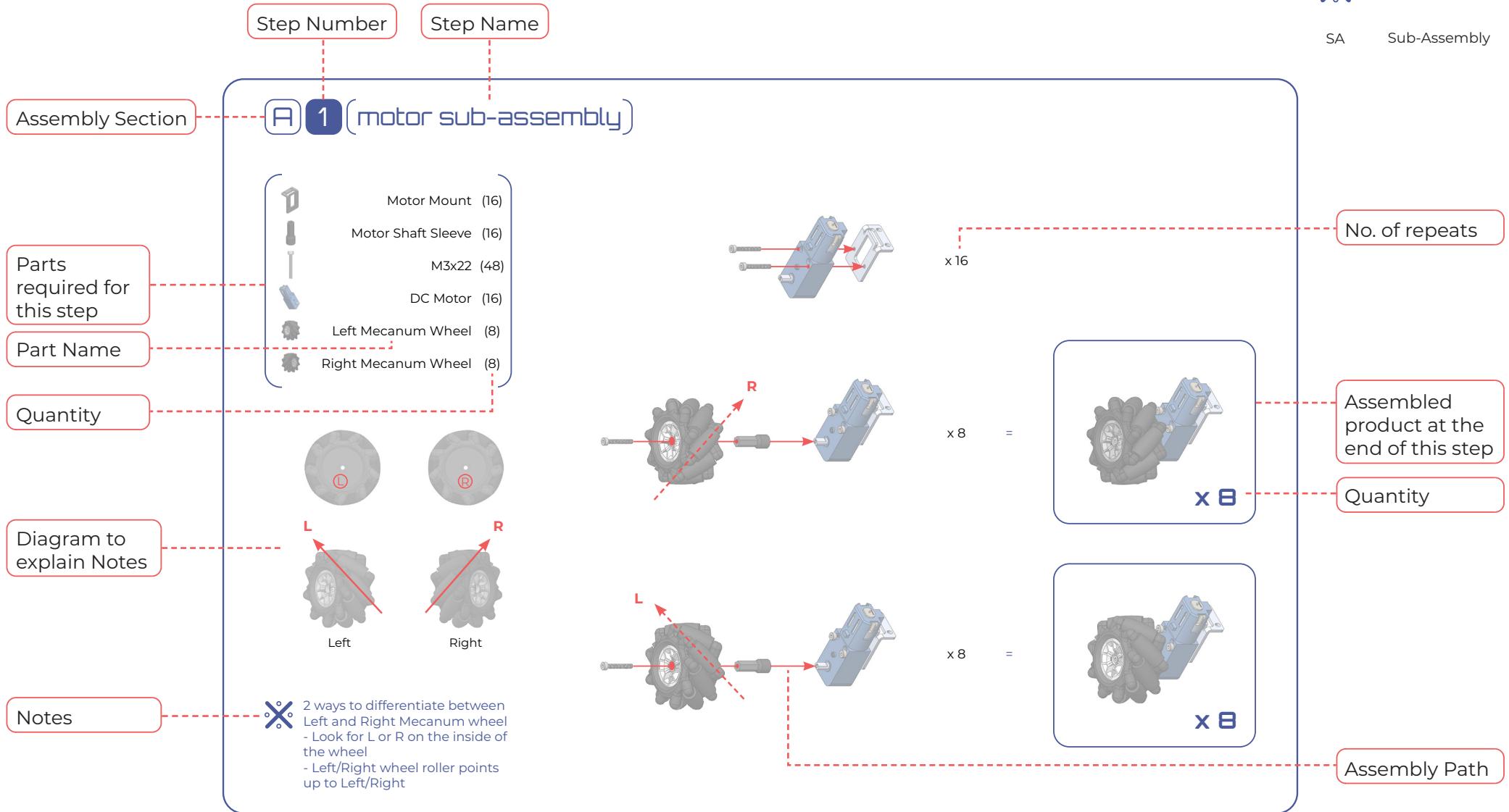


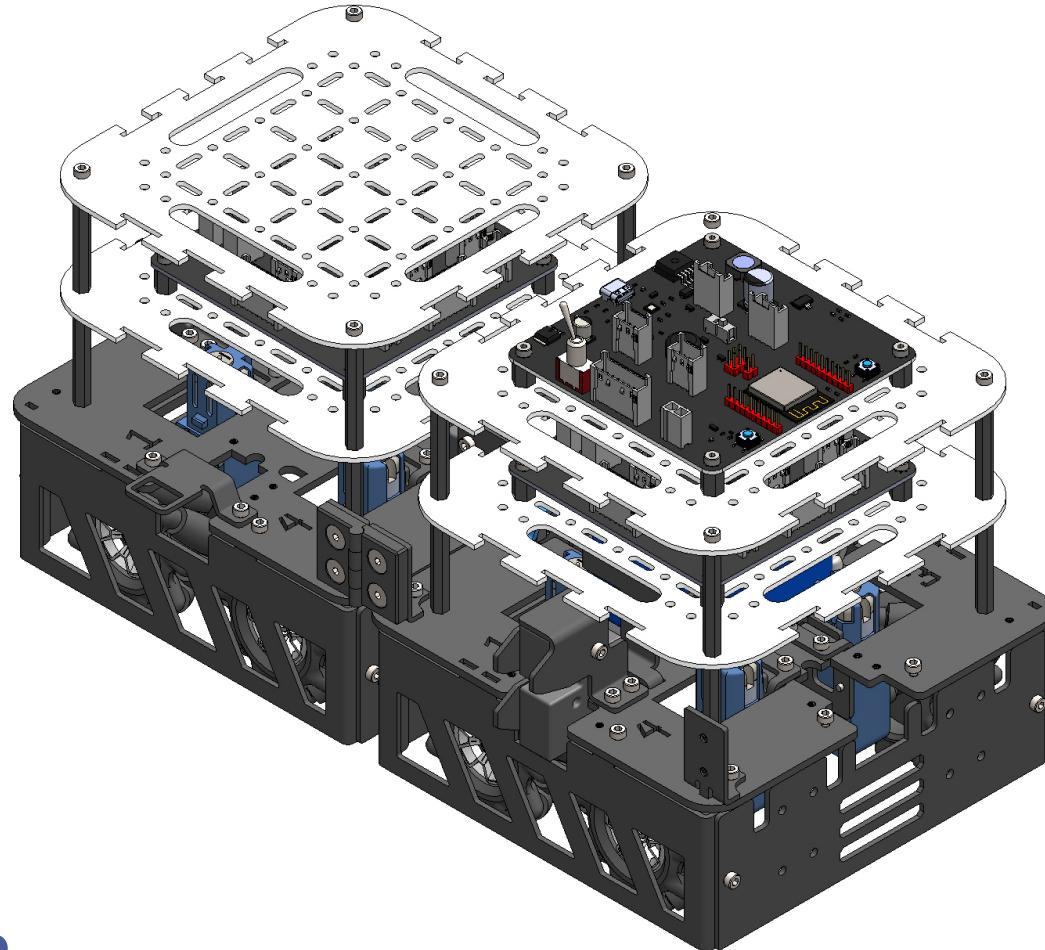
12 x Hex F-F M3 Nylon 10mm



# ( basic assembly tips )

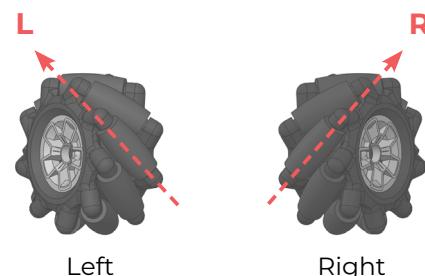
Symbols Used	
	Rotate Part
	Assembly Path
	Important Note
SA	Sub-Assembly



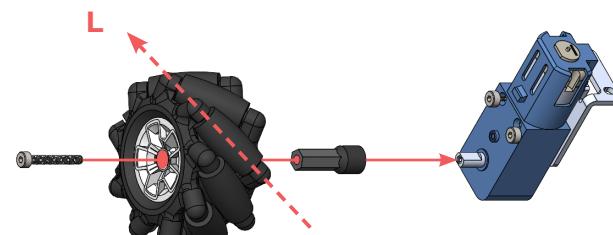
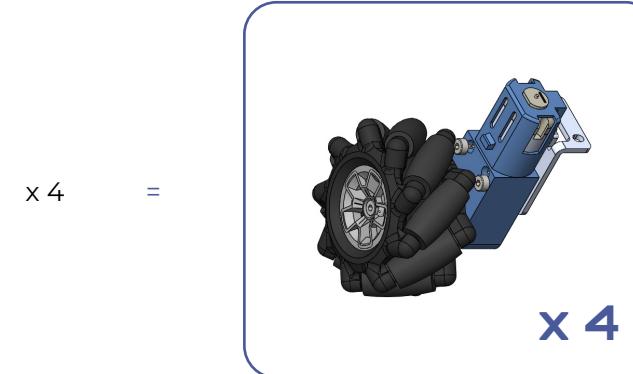
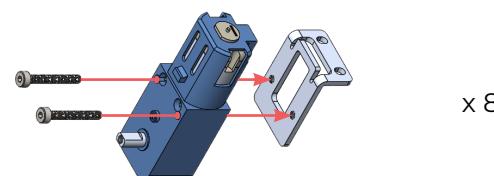


**smorphi<sup>e</sup>**  
assembly start

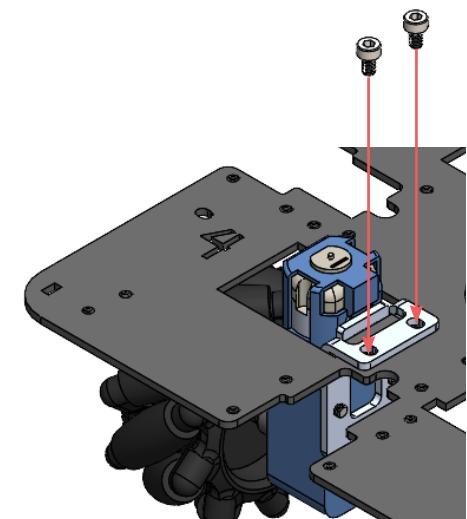
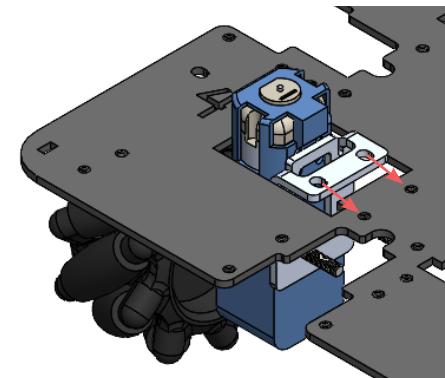
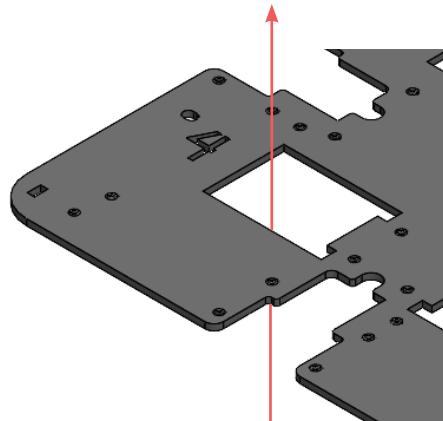
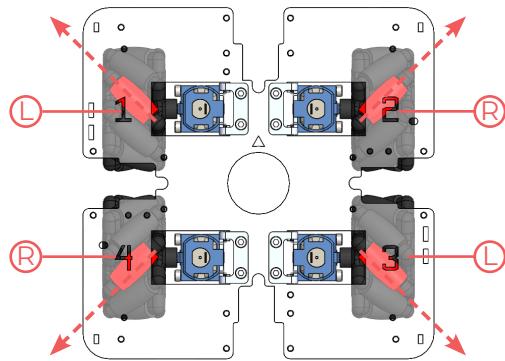
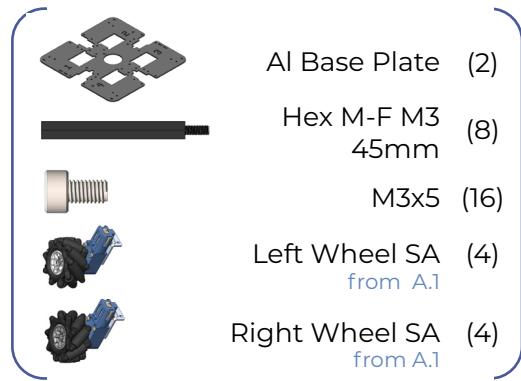
# A 1 (motor sub-assembly)



2 ways to differentiate between Left and Right Mecanum wheel  
- Look for L or R on the inside of the wheel  
- Left/Right wheel roller points up to Left/Right

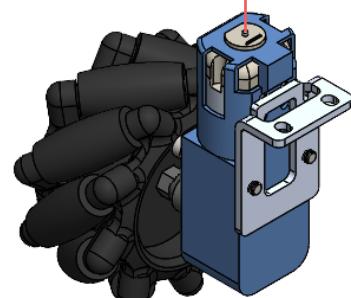


## A2 (base module sub-assembly)

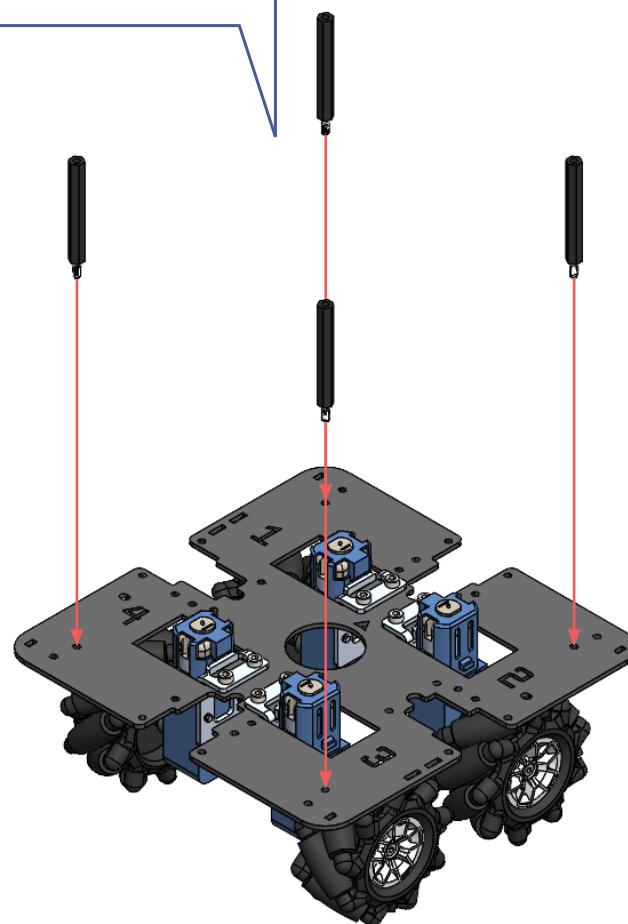
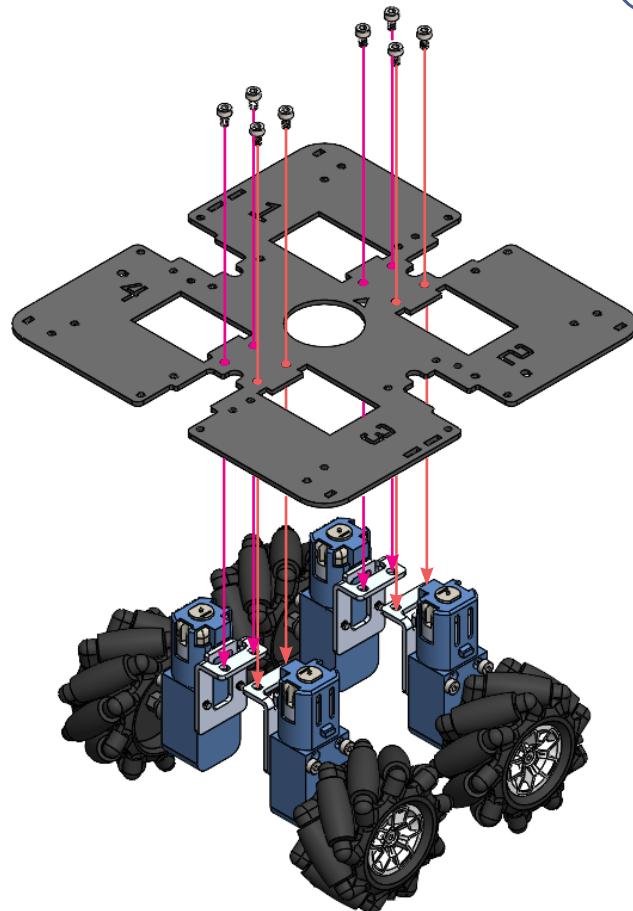
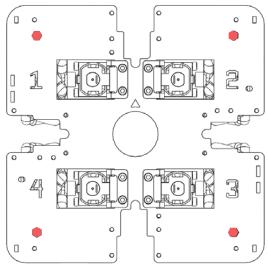


✖ Make sure that the numbers are facing the right way up as shown in the plan view above.

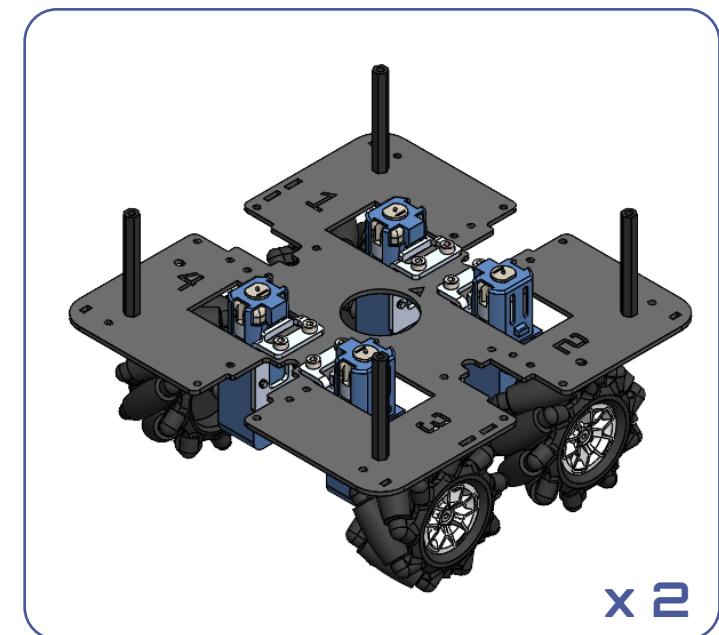
✖ Before attaching each wheel, check that the wheel is of the correct orientation for each numbered slot.

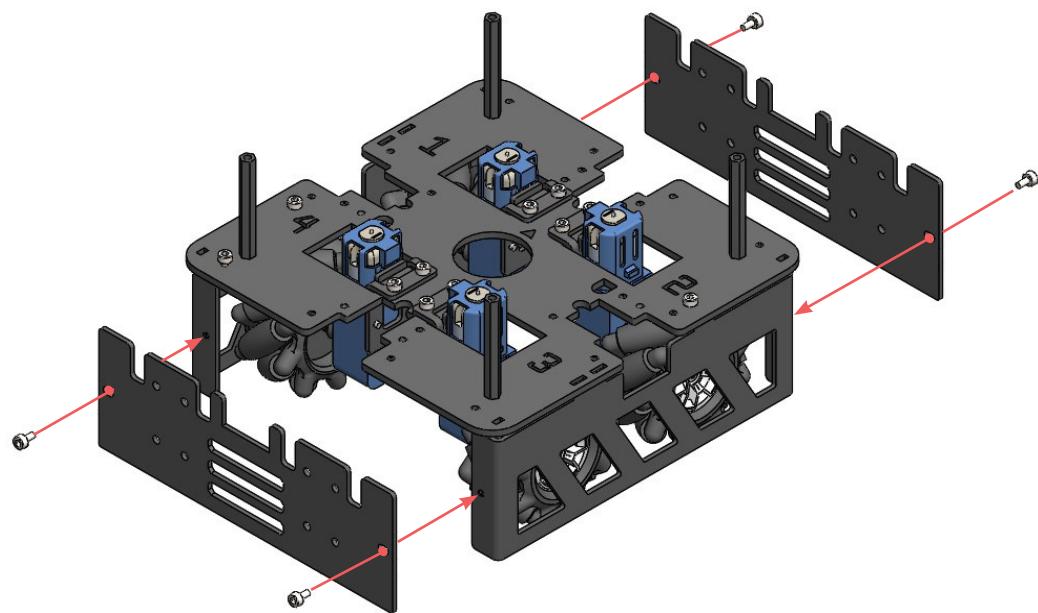
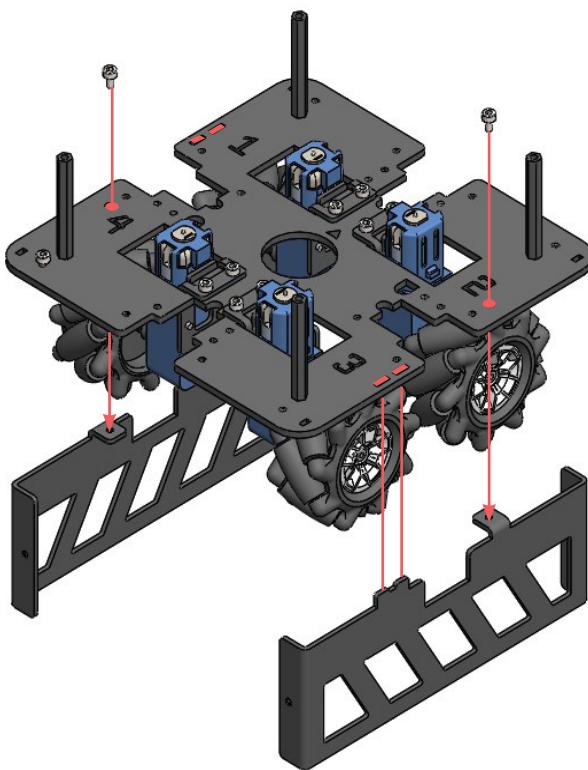
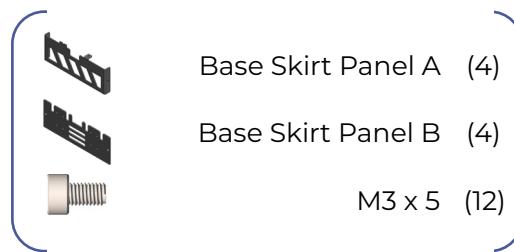


plan view

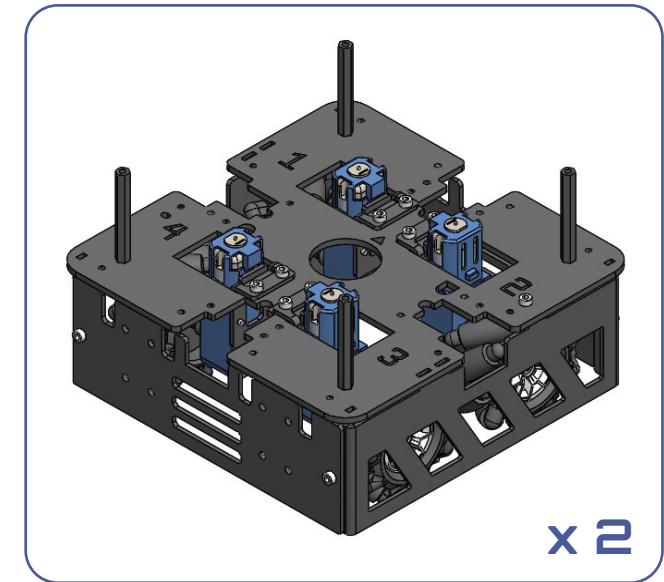


x 2 =

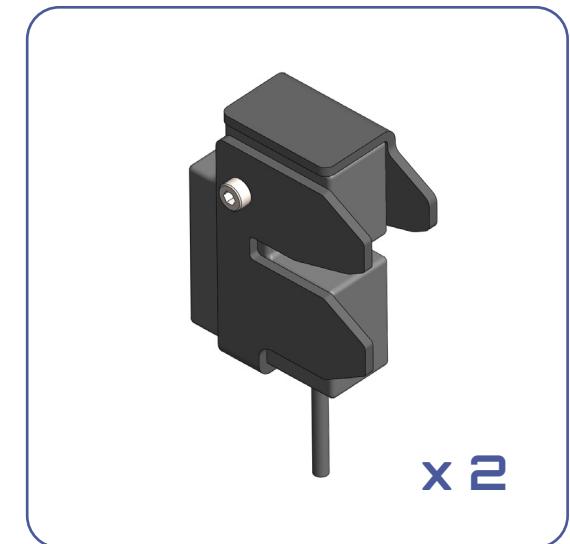
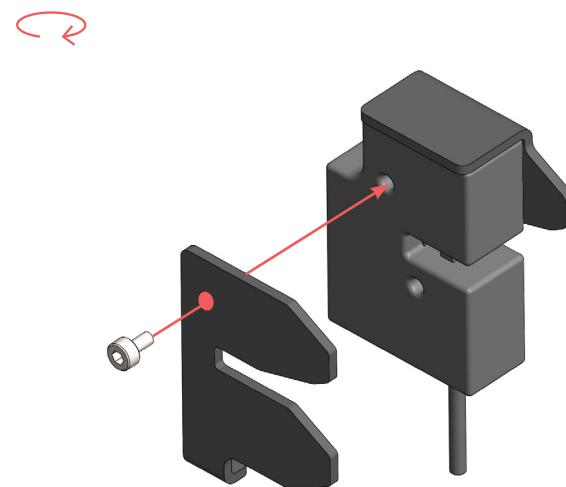
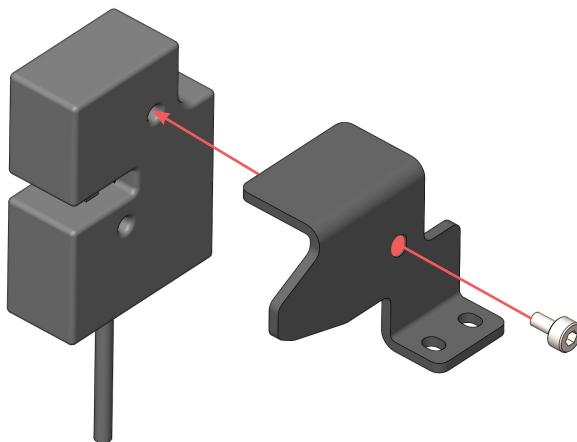




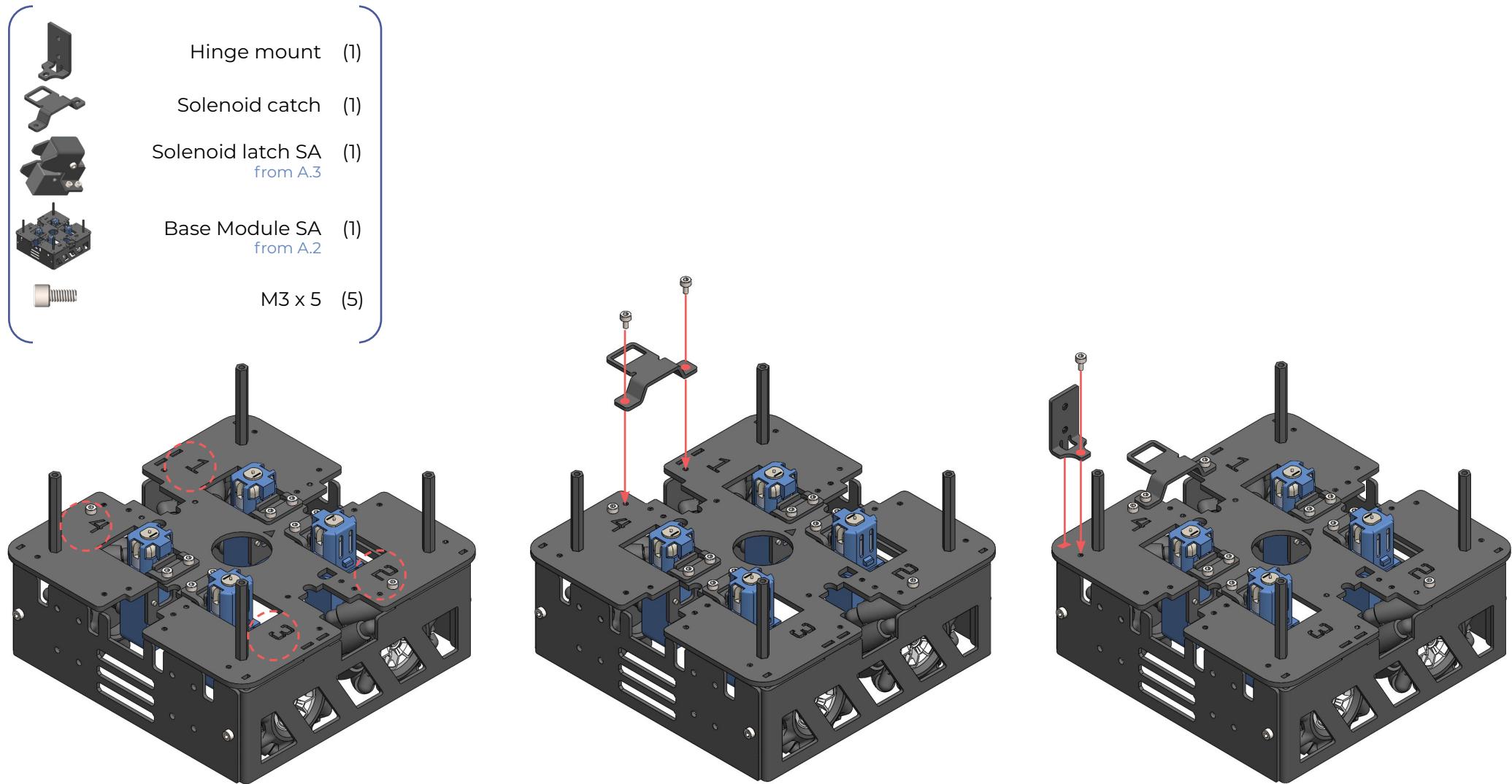
x 2 =



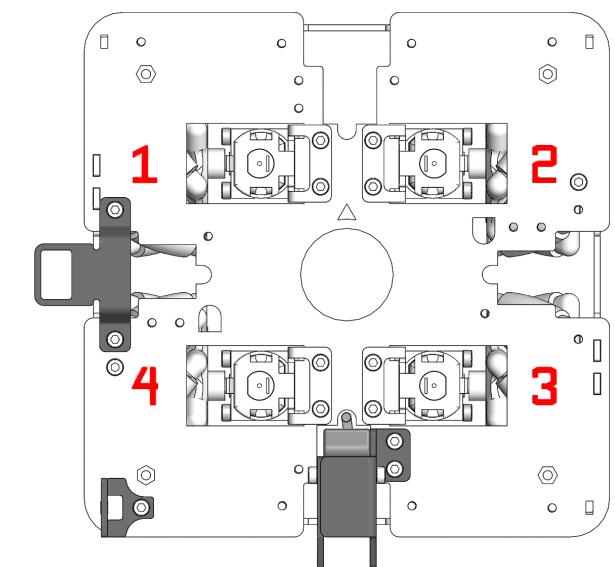
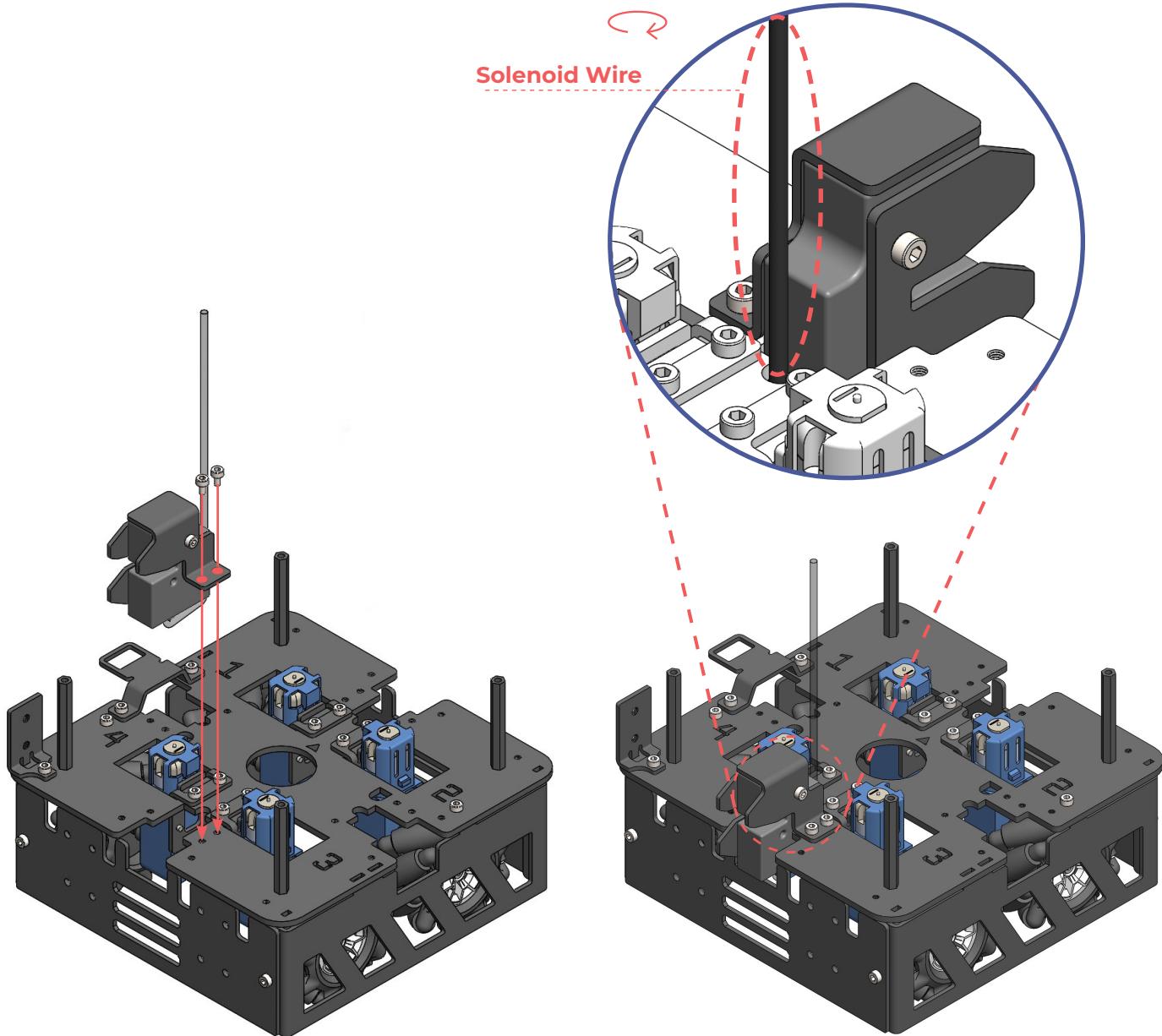
A3 (solenoid latch sub-assembly)



## A 4 (module 1 mechanical sub-assembly)

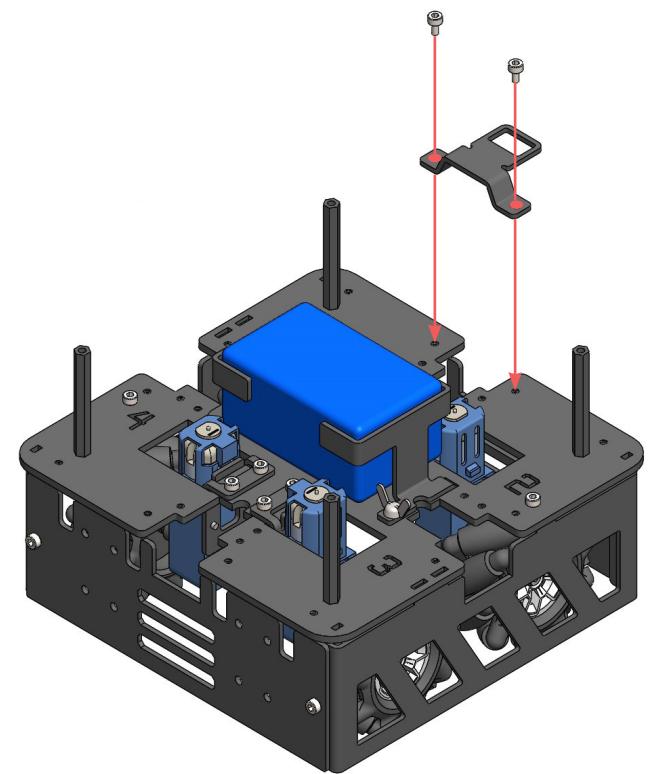
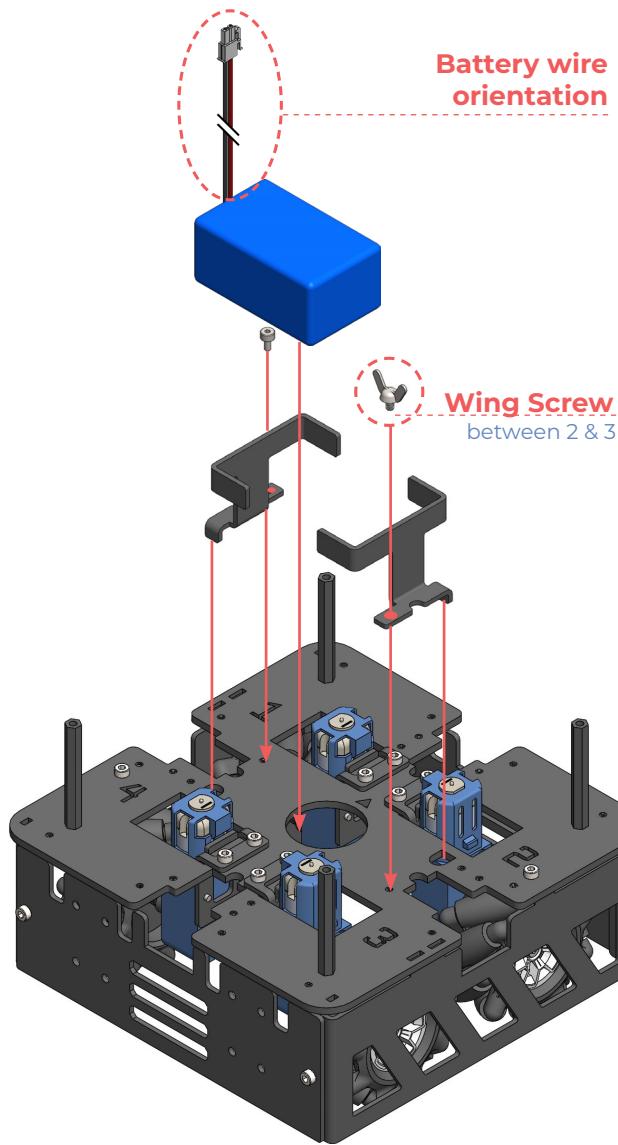
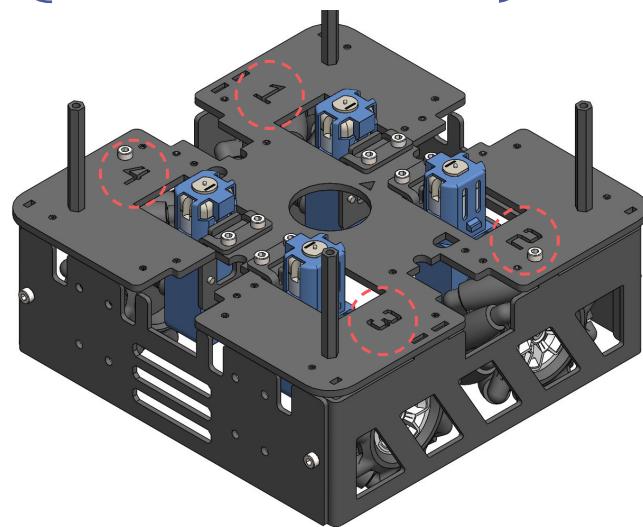
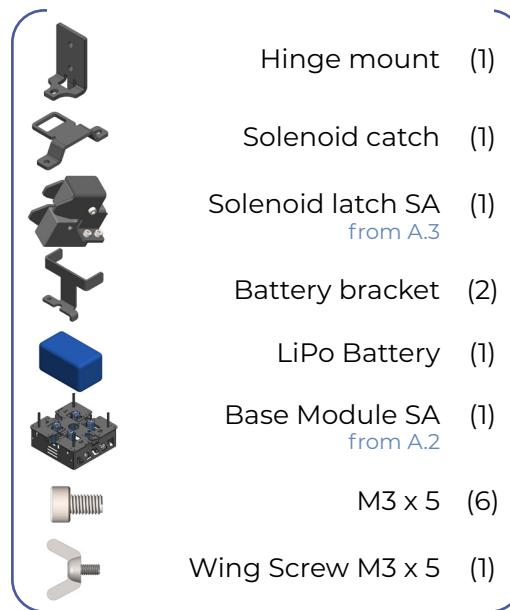


Pay attention to the numbers and their positions in relation to the parts being attached.

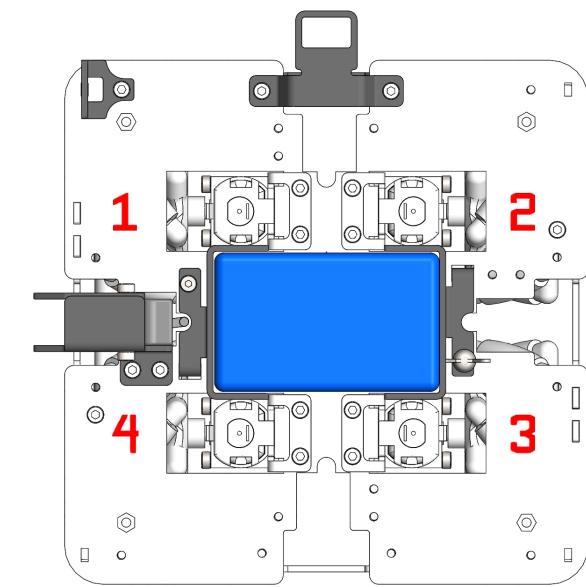
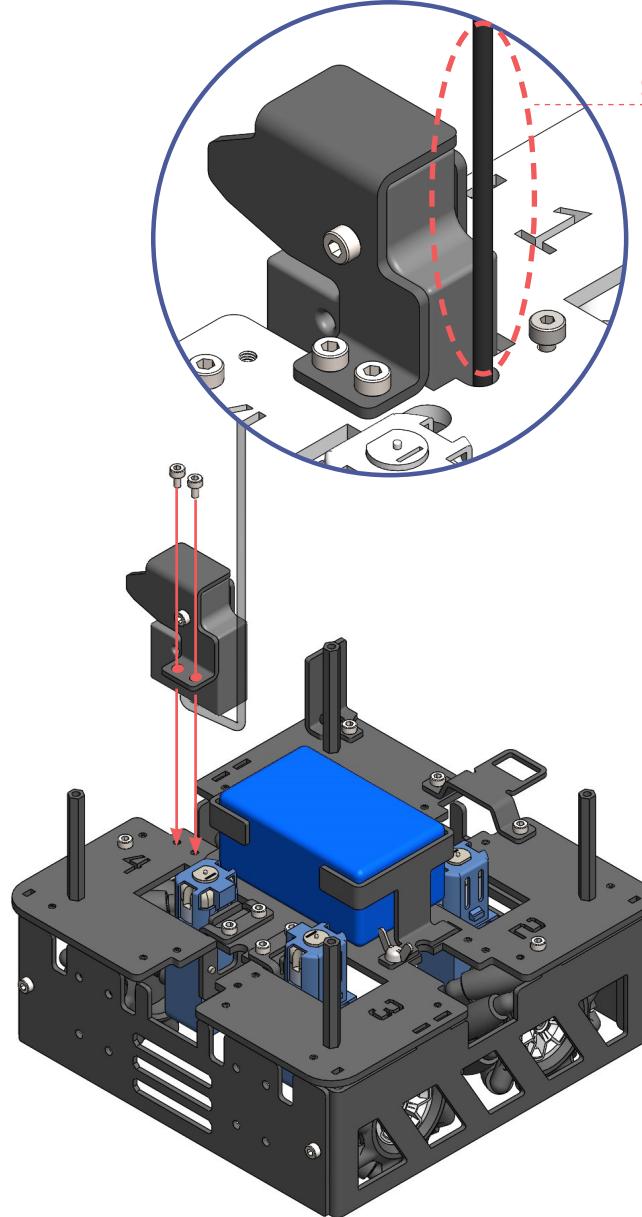
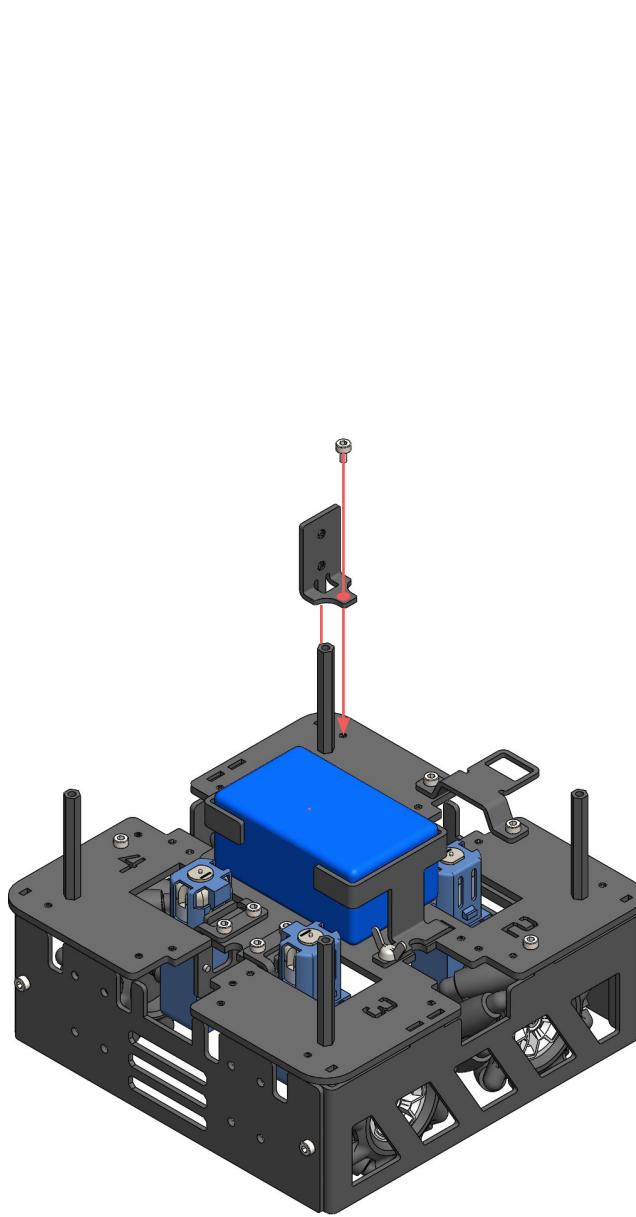


Check that the parts have been attached in the right location, in relation to the numbers.

## A5 (module 2 mechanical sub-assembly)

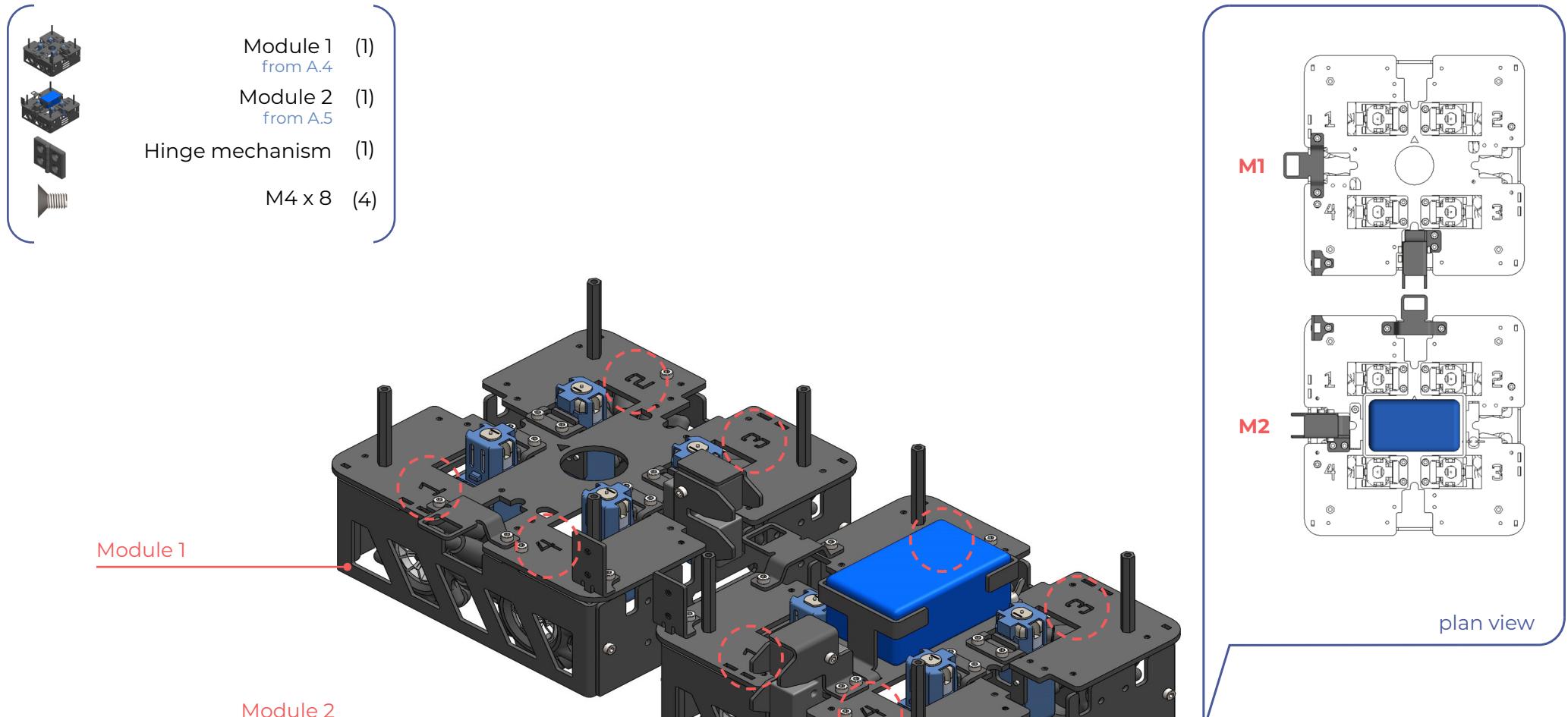


Pay attention to the numbers and their positions in relation to the parts being attached.

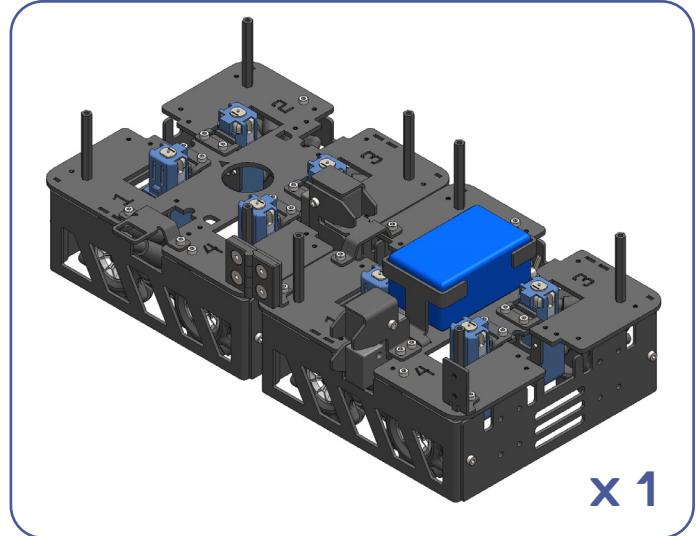
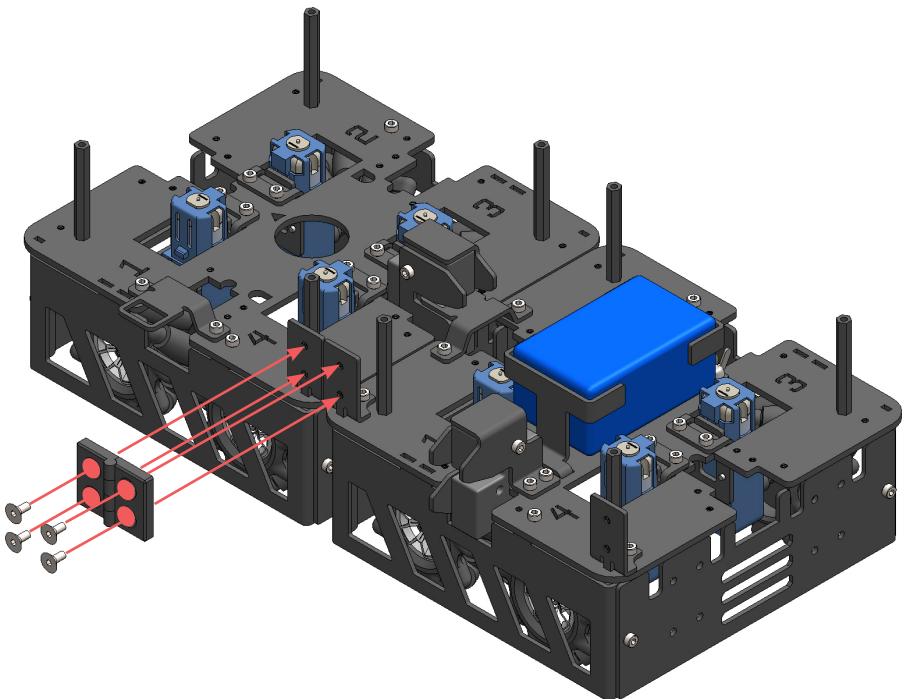
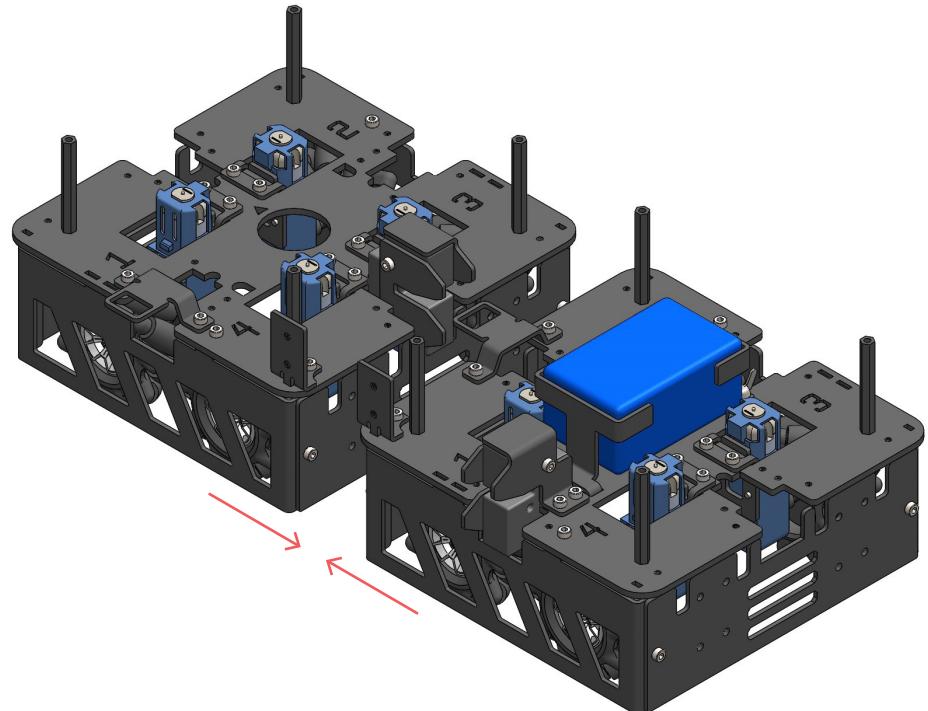


Check that the parts have been attached in the right location.

## A6 (full mechanical assembly)



Pay attention to the numbers and their orientation  
when attaching the modules together.

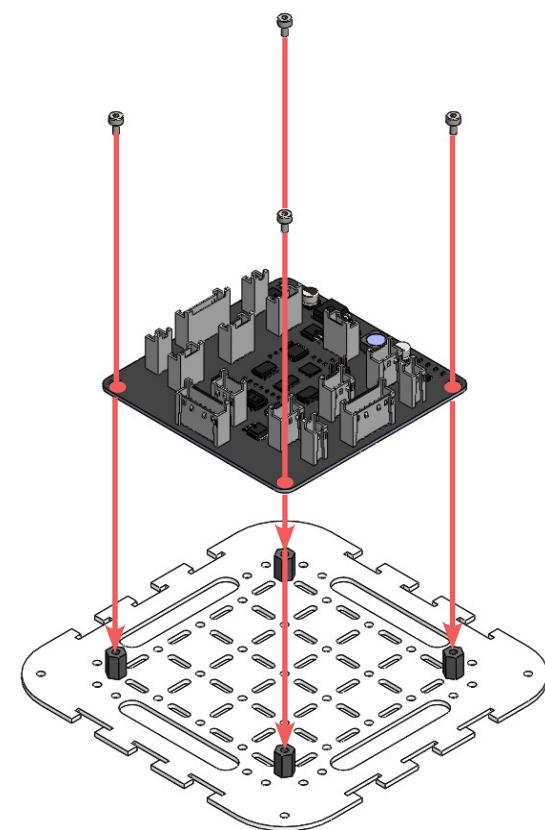
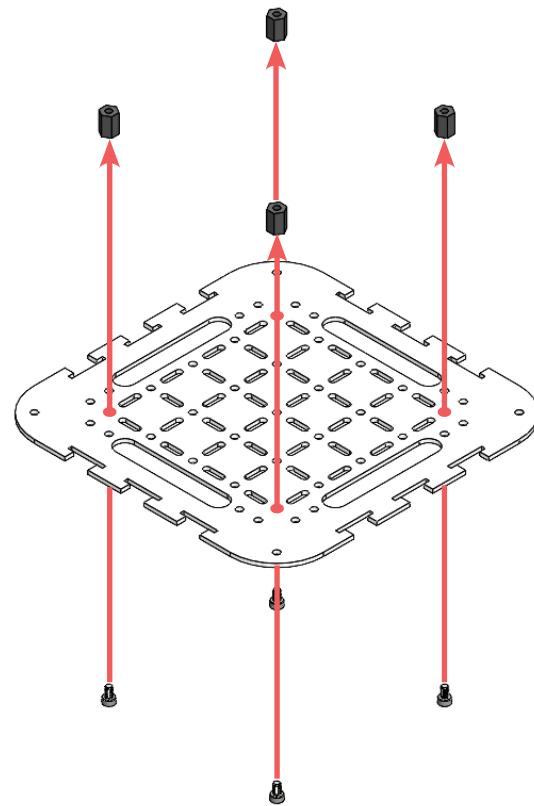
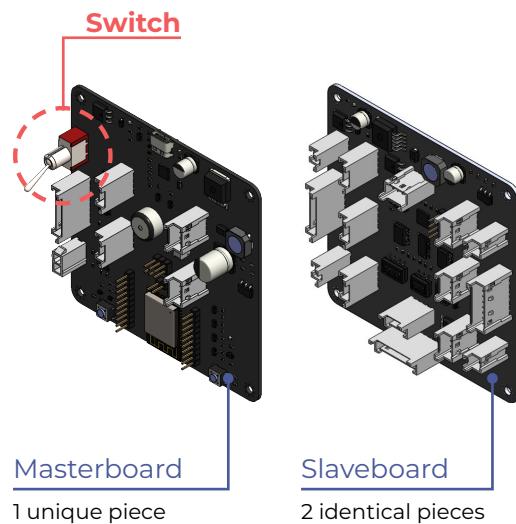
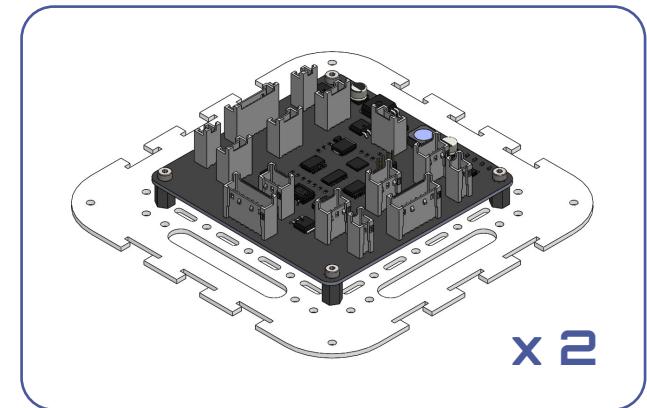


Check all the positions of solenoids, solenoid catches, hinge mounts before proceeding to section B.



mechanical assembly completed

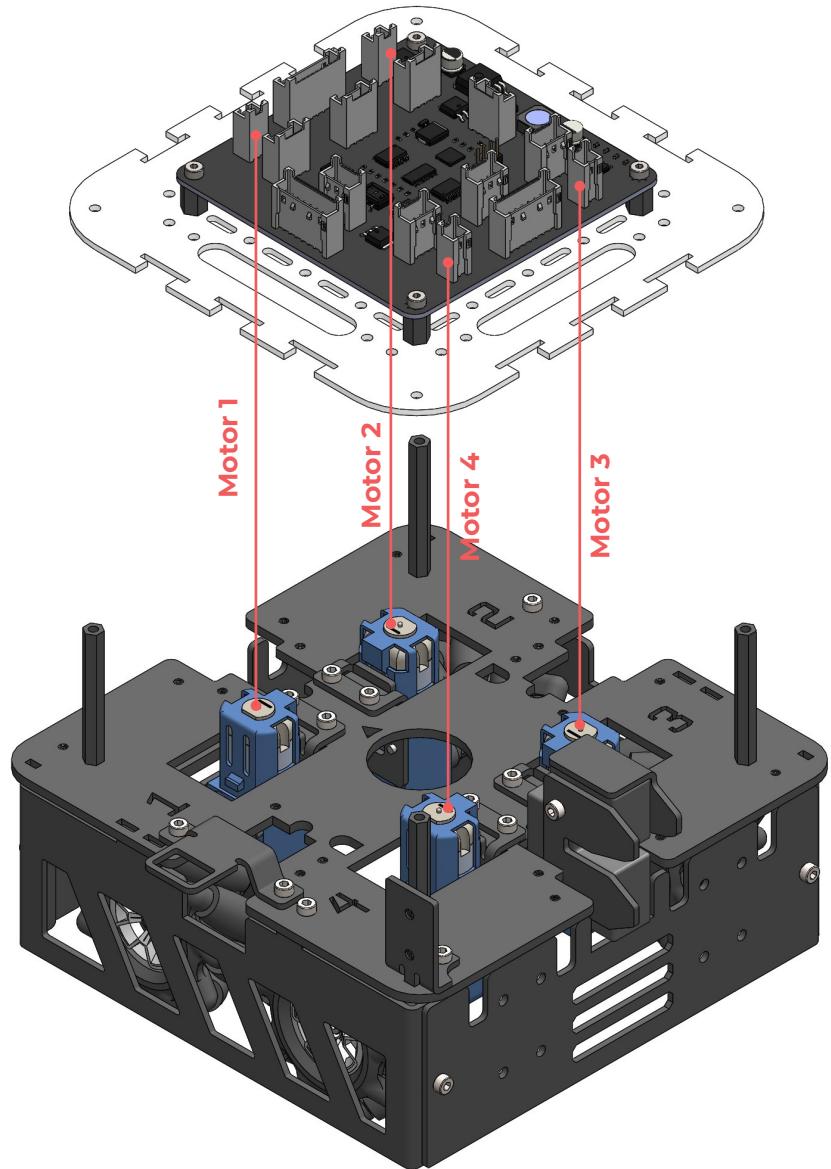
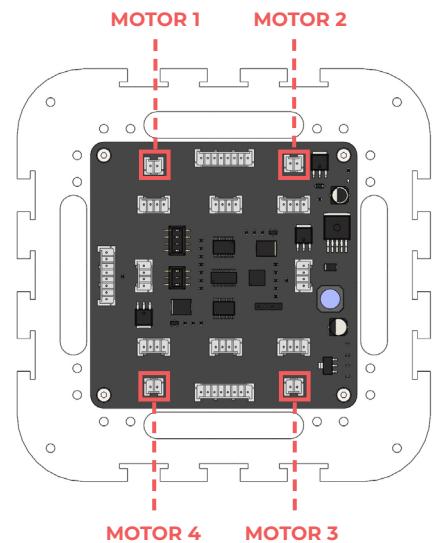
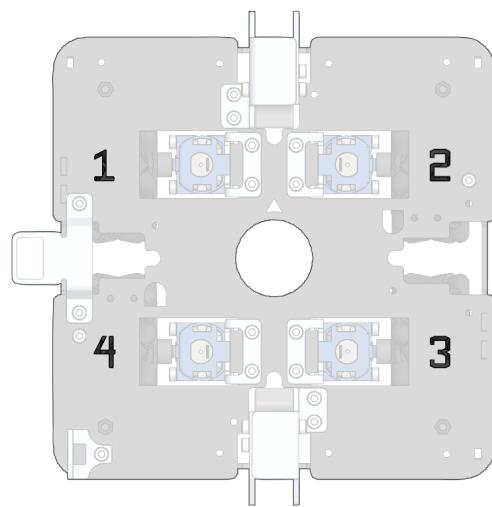
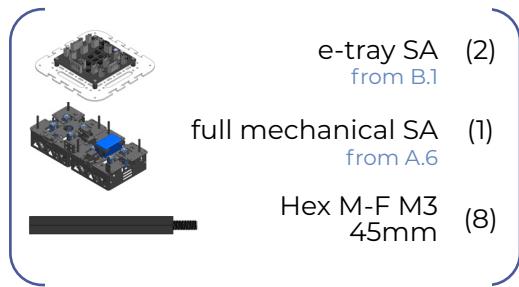
## B 1 (e-tray sub-assembly)



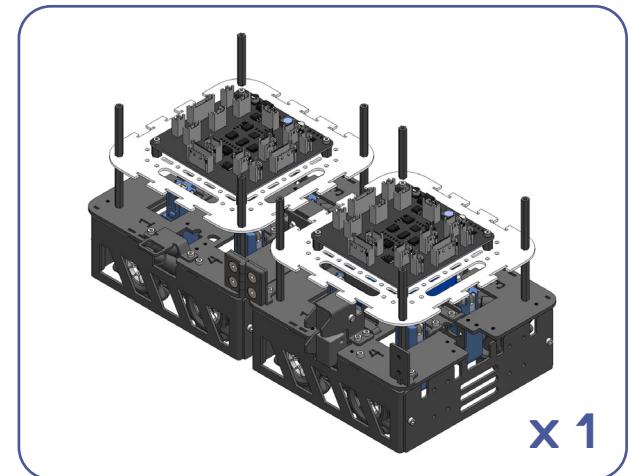
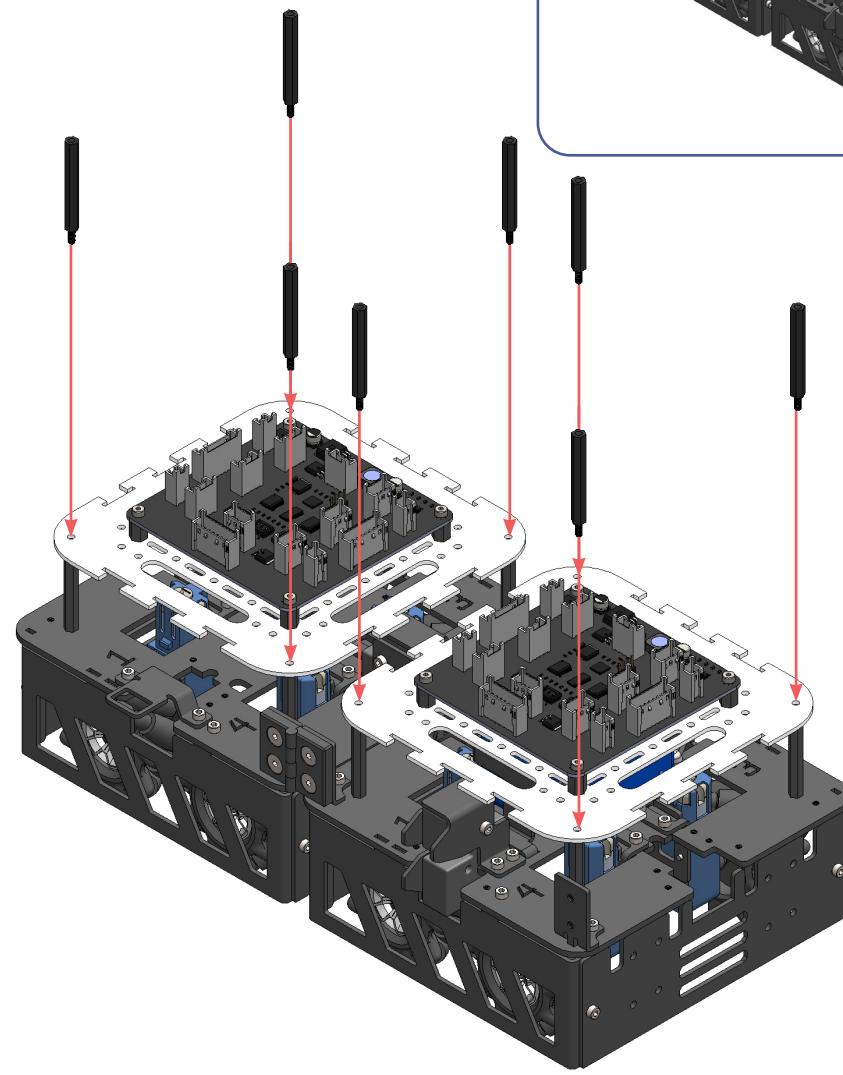
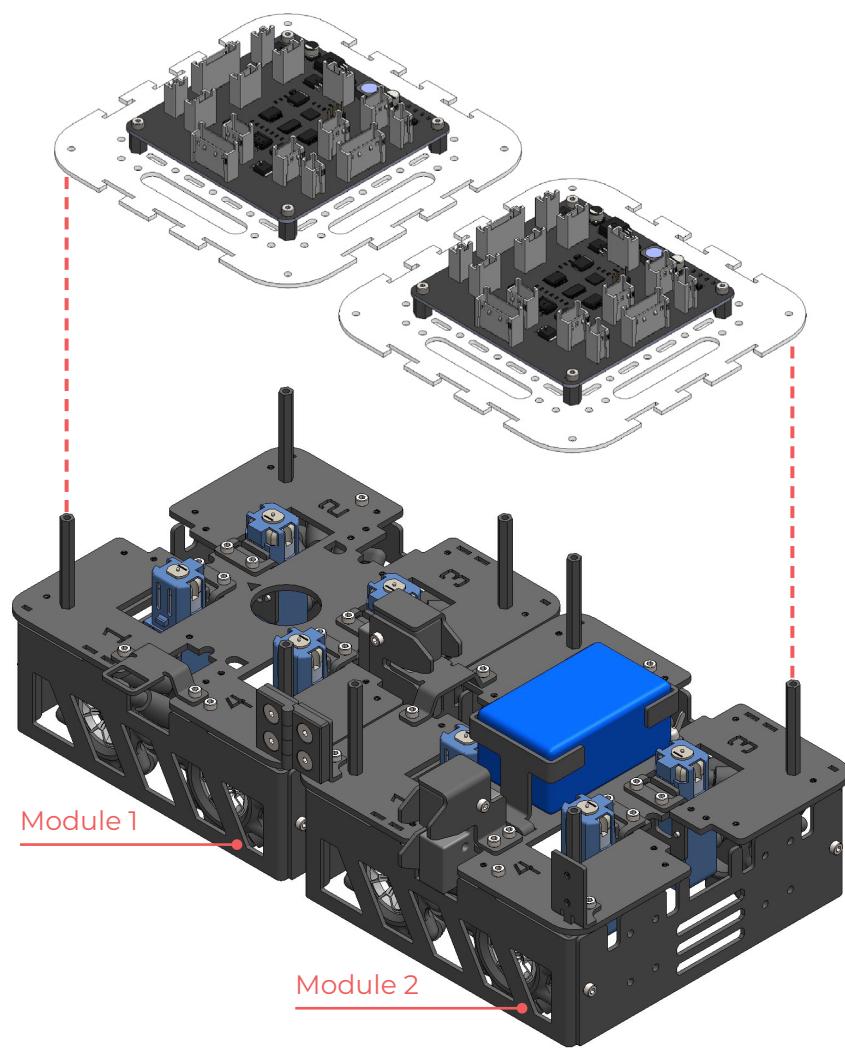
✖ Make sure that you are attaching the slaveboards and not the masterboard.

✖ How to differentiate between masterboard and slaveboards:  
- Masterboard has a special switch

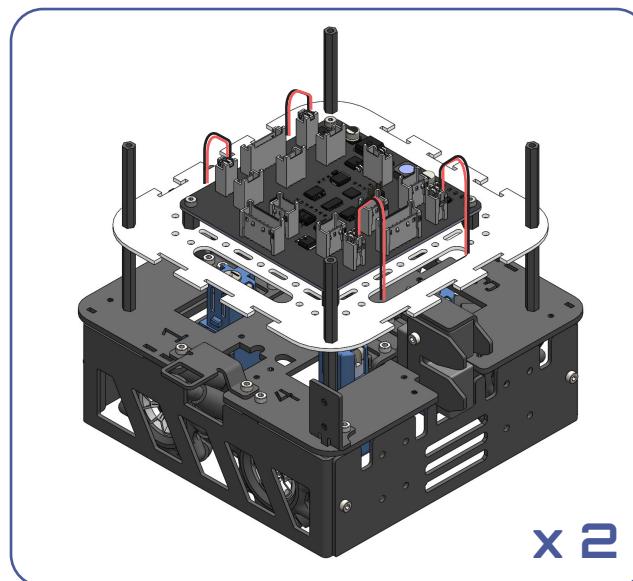
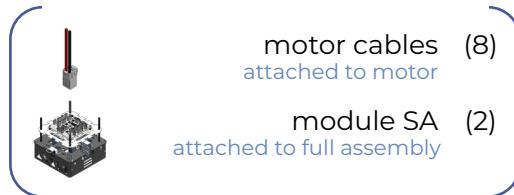
## B2 (e-tray onto mechanical assembly)



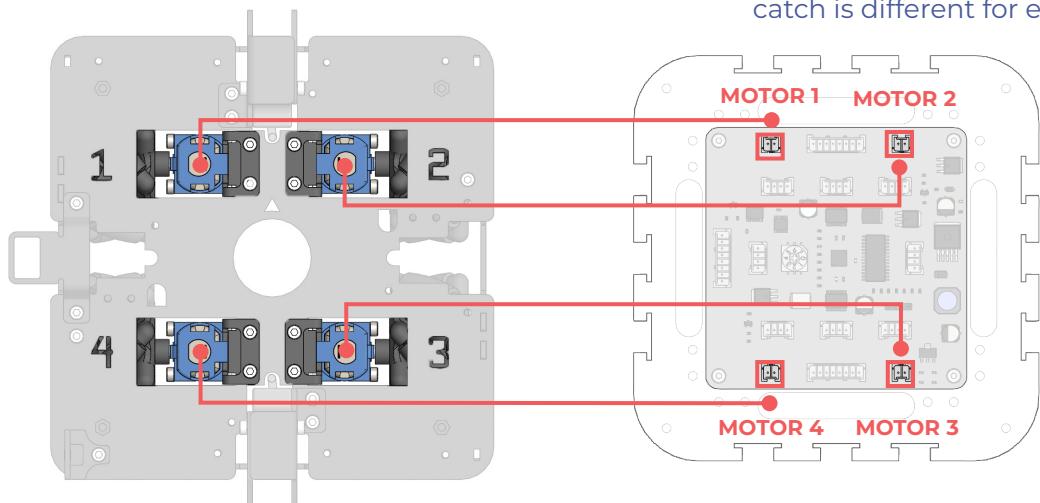
Orientate e-tray SA and base module as shown on the right.  
Motor 1 connector on e-tray should be on top of Motor 1 of base module.  
Same goes for Motor 2, 3 and 4.



## B3 (all module motor cable connection)

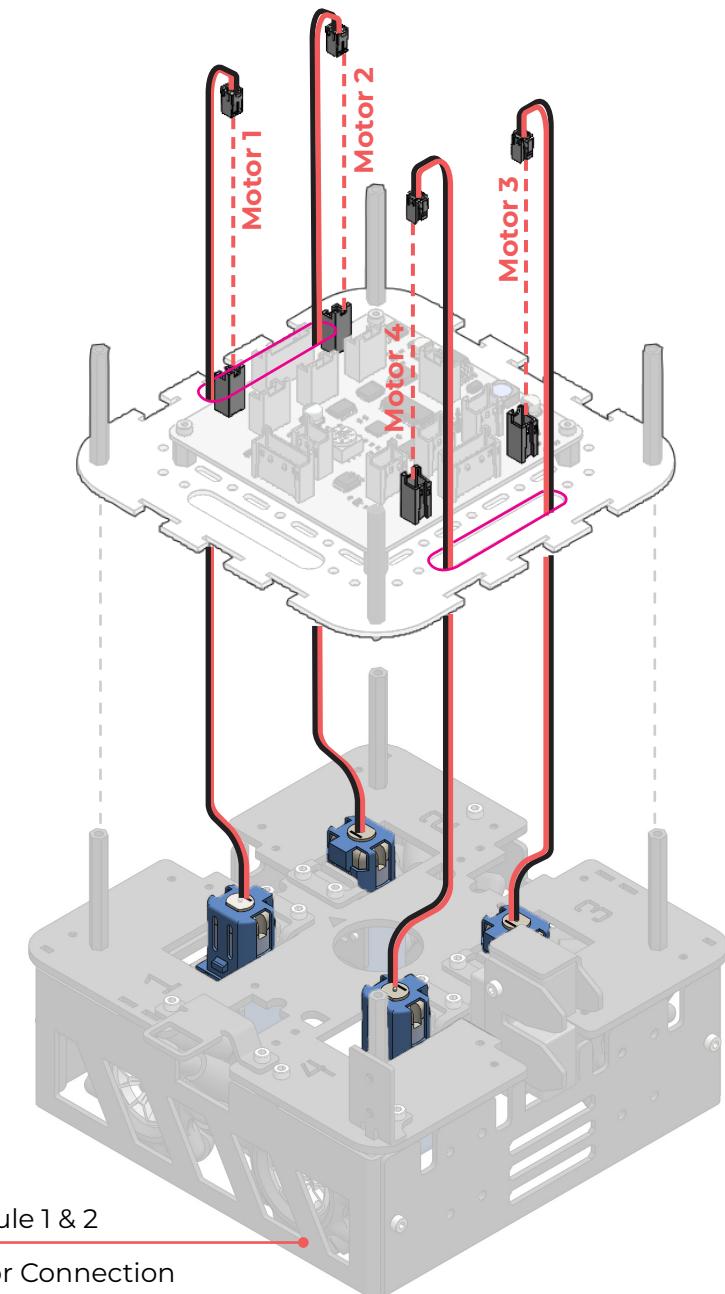


Note: Position of solenoid latch and solenoid catch is different for each module



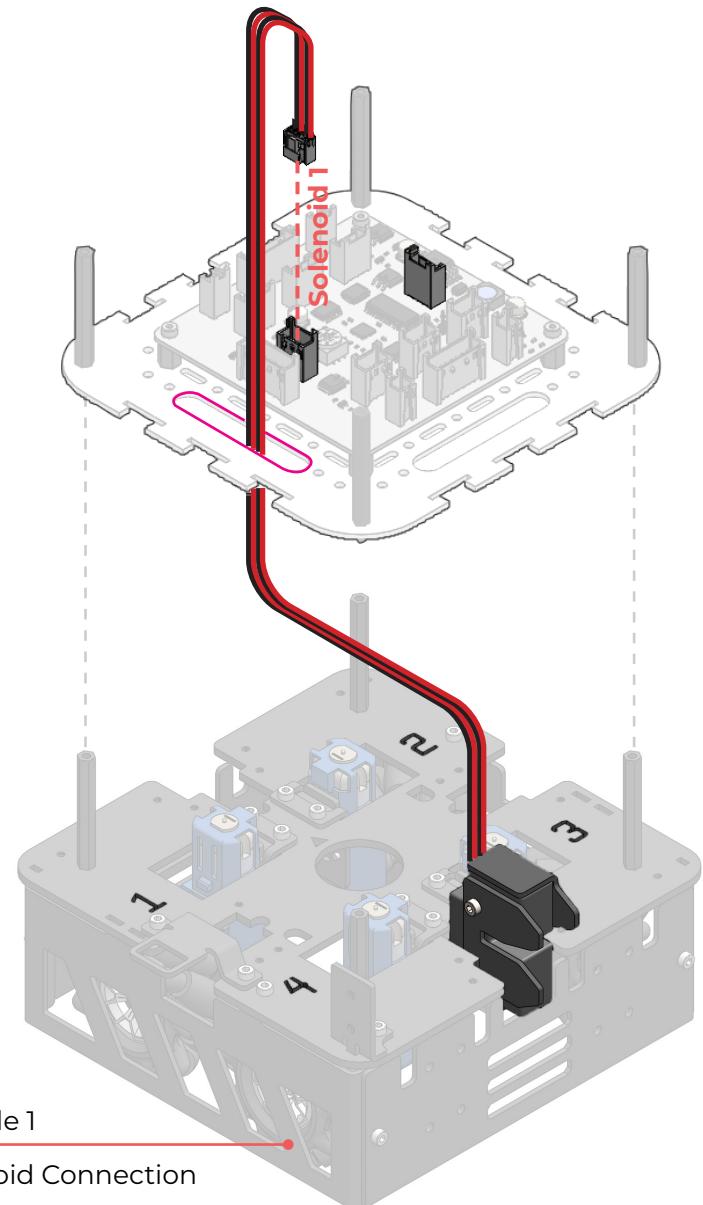
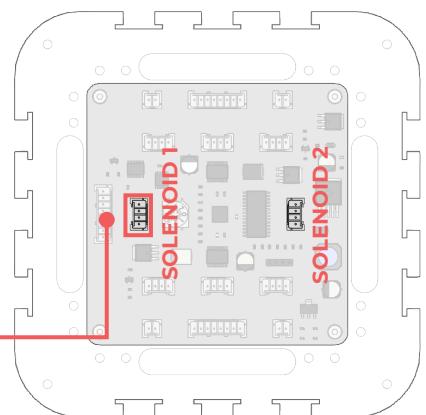
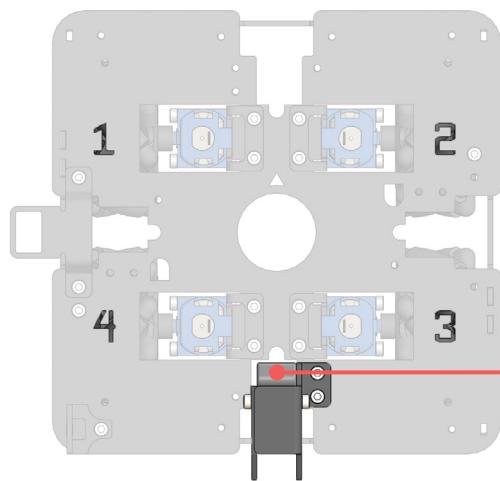
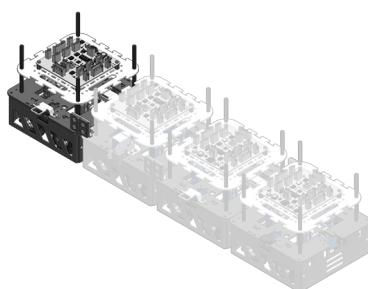
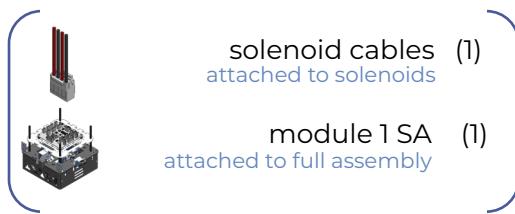
Make sure that Motor 1 is connected to Motor 1 connector on Slaveboard; the same goes for Motor 2, 3 and 4.

Motor cable connection is the same for both modules



Opening to pass wire through

## B 4 (module 1 solenoid cable connection)



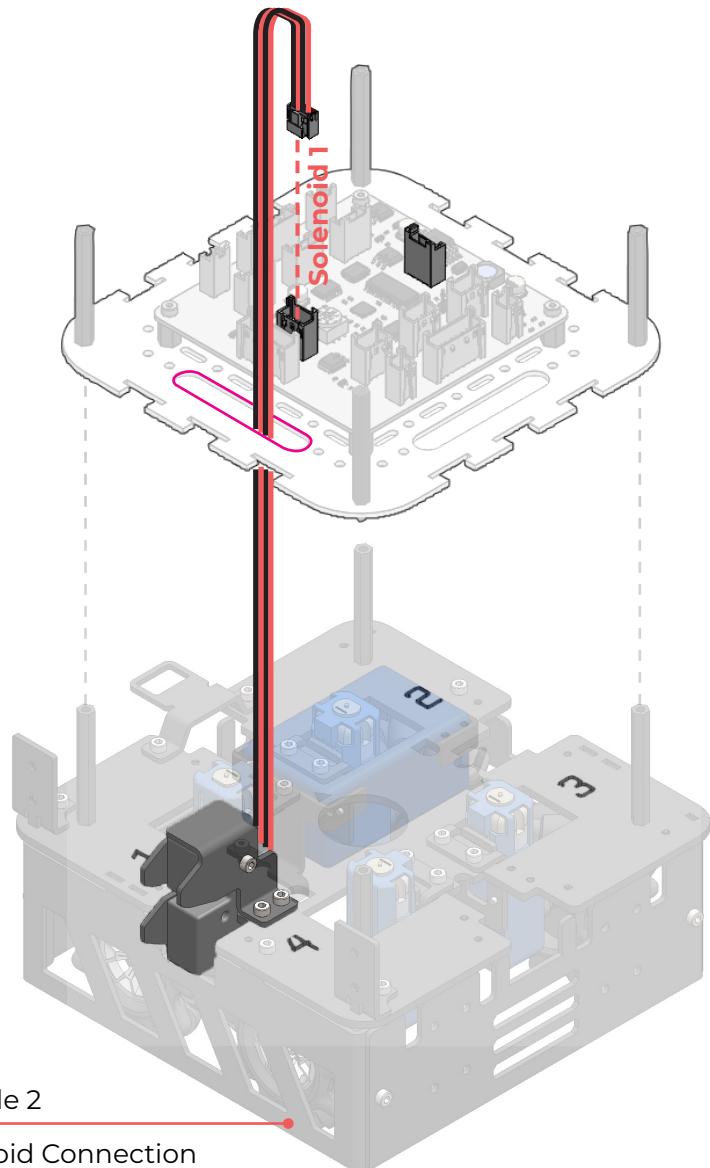
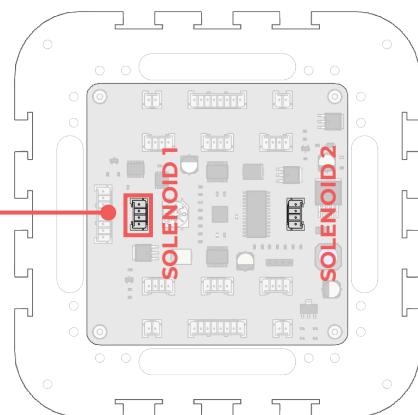
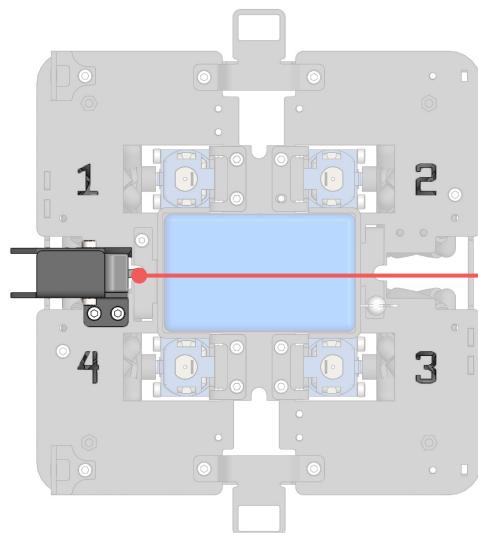
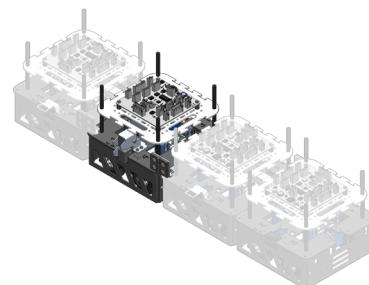
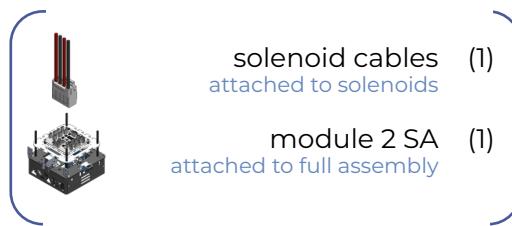
Module 1  
Solenoid Connection

Opening to pass wire through



Make sure to connect the solenoid to the labelled solenoid connector exactly as in the diagram below.

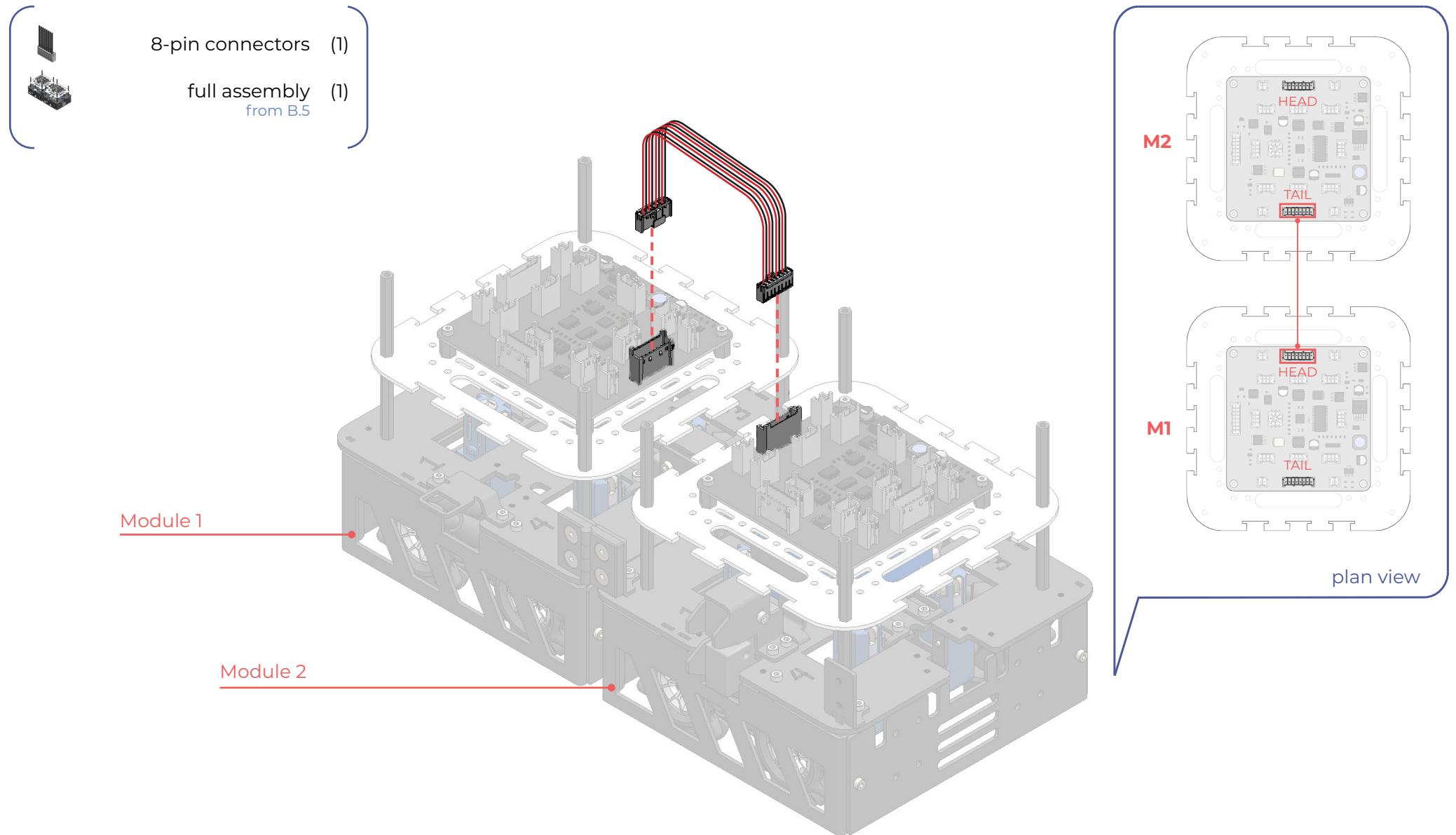
## B5 (module 2 solenoid cable connection)



 Make sure to connect the solenoid to the labelled solenoid connector exactly as in the diagram below.

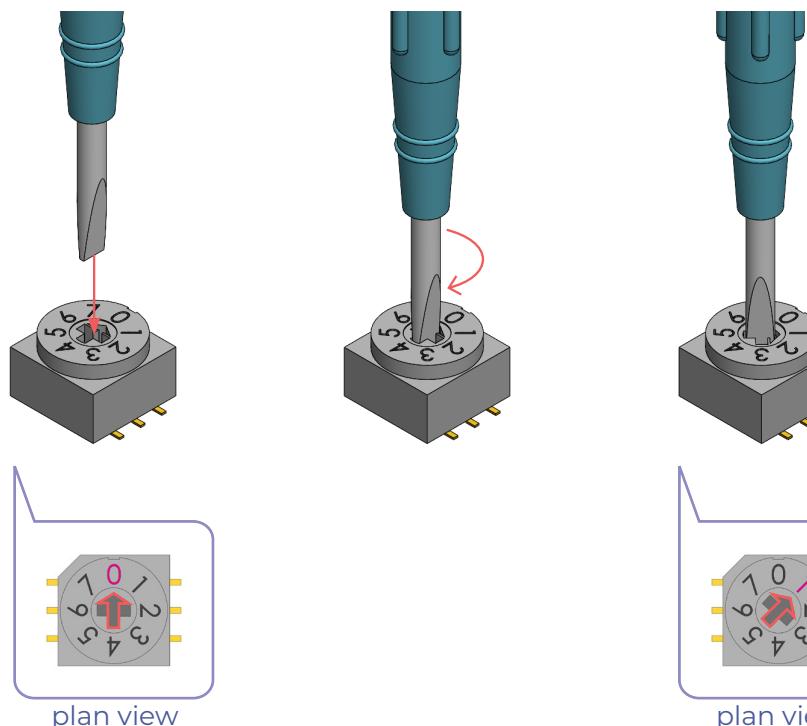
 Opening to pass wire through

## B6 (inter-module cable connection)



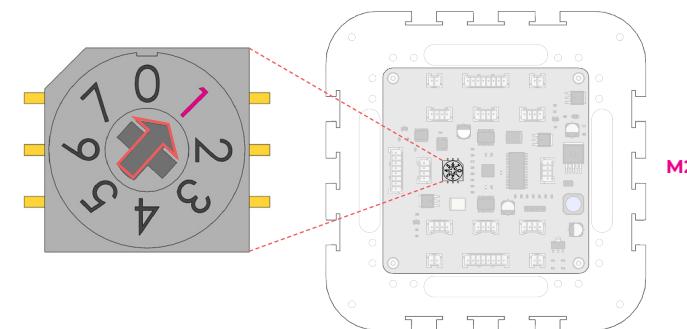
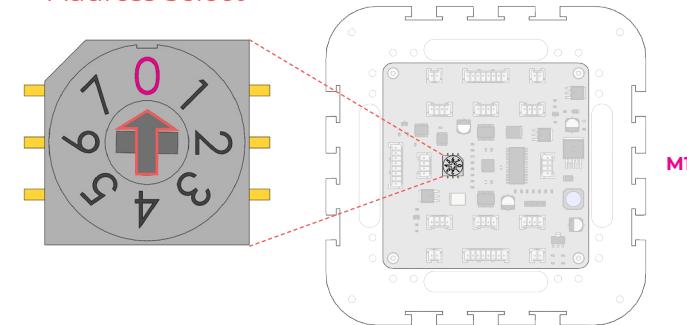
## B7 (address selection)

full assembly (1)  
from B.6  
ceramic screwdriver (1)

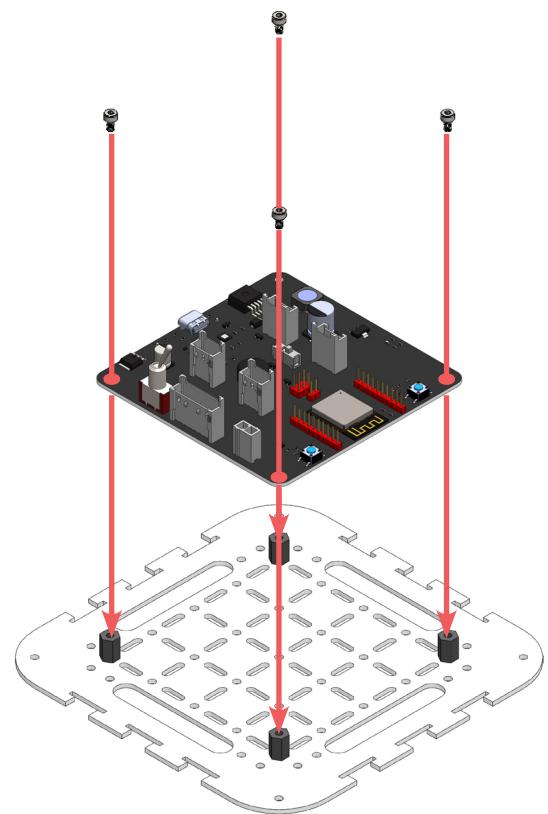
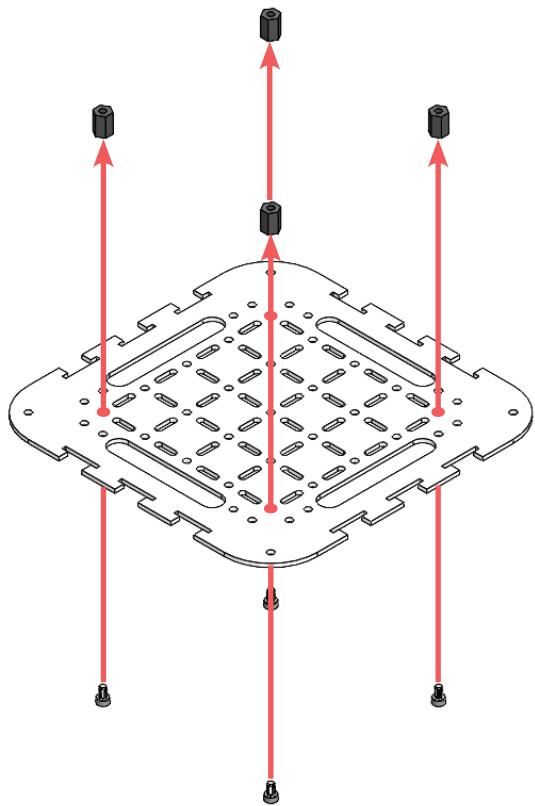
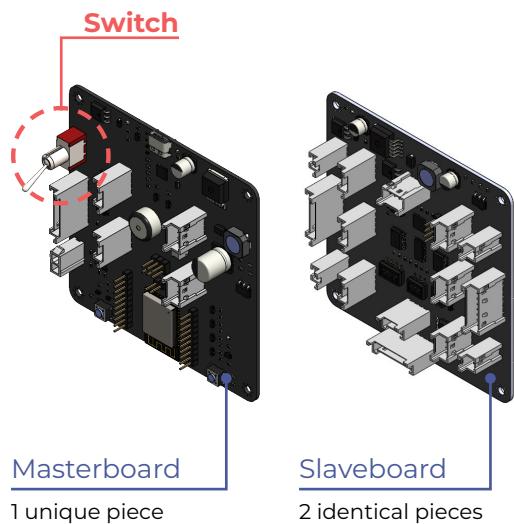
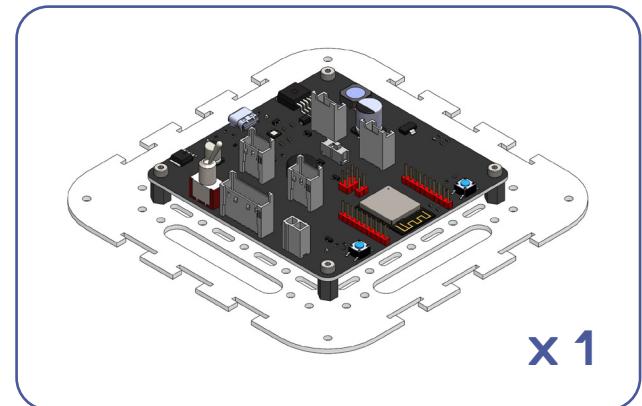


Use the ceramic screwdriver to adjust the rotary switch and select the address for all 2 modules.  
Module 1: Address 0, Module 2: Address 1

Address Select

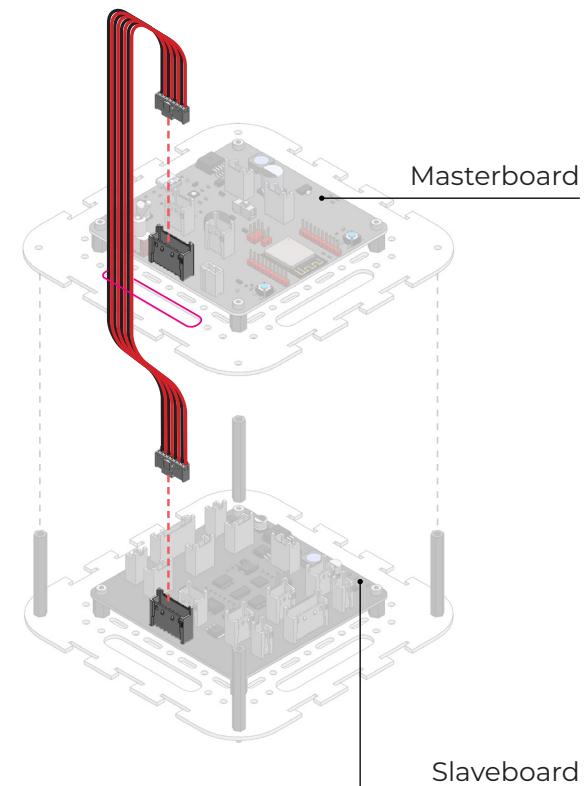
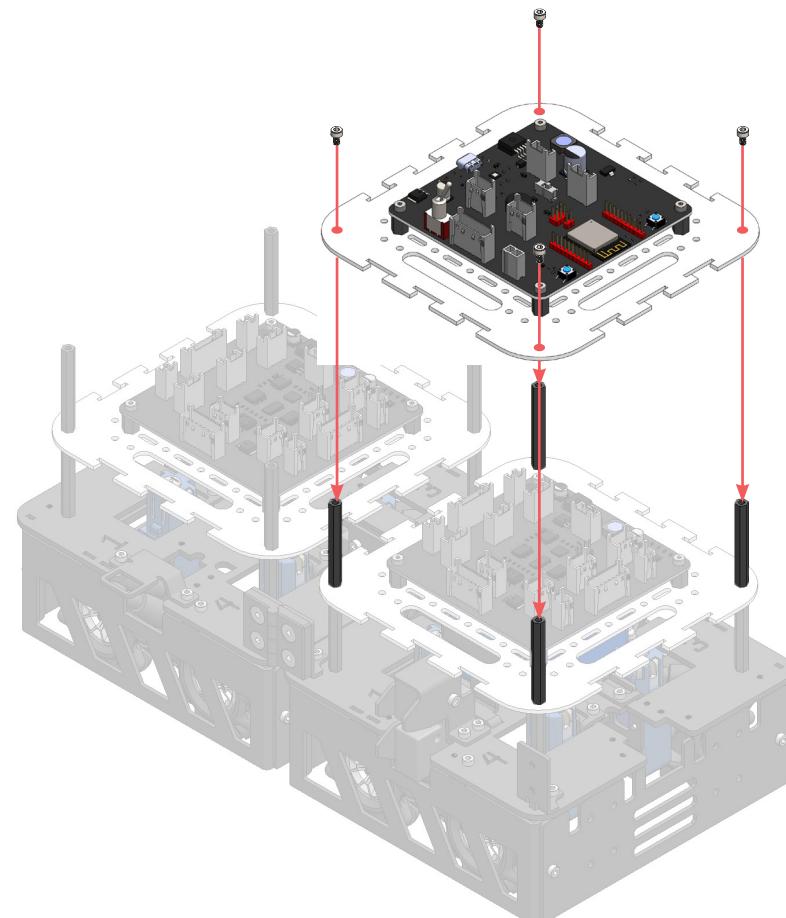
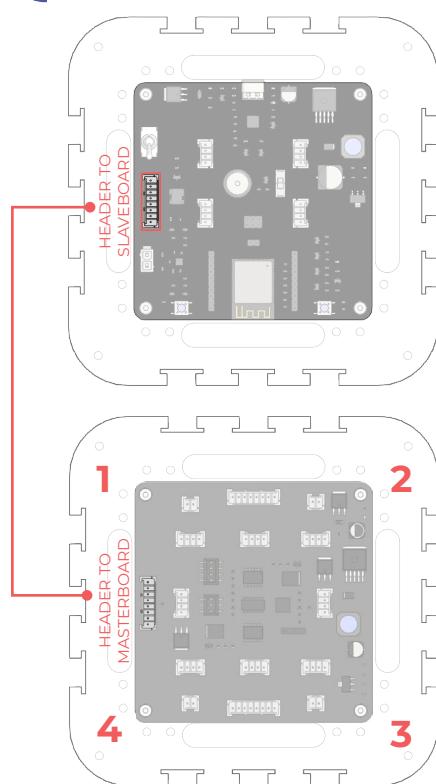
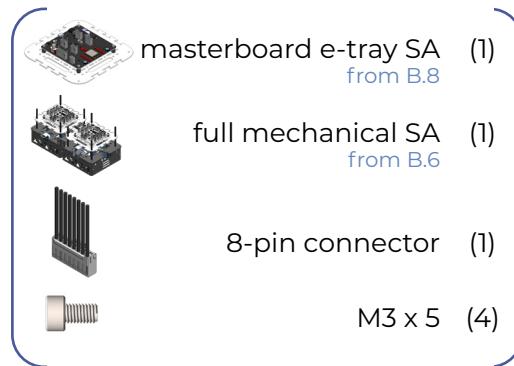


## B8 (masterboard e-tray sub-assembly)



- ✗ Make sure that you are attaching the masterboard and not the slaveboards.
- ✗ How to differentiate between masterboard and slaveboards:
  - Masterboard has a special switch

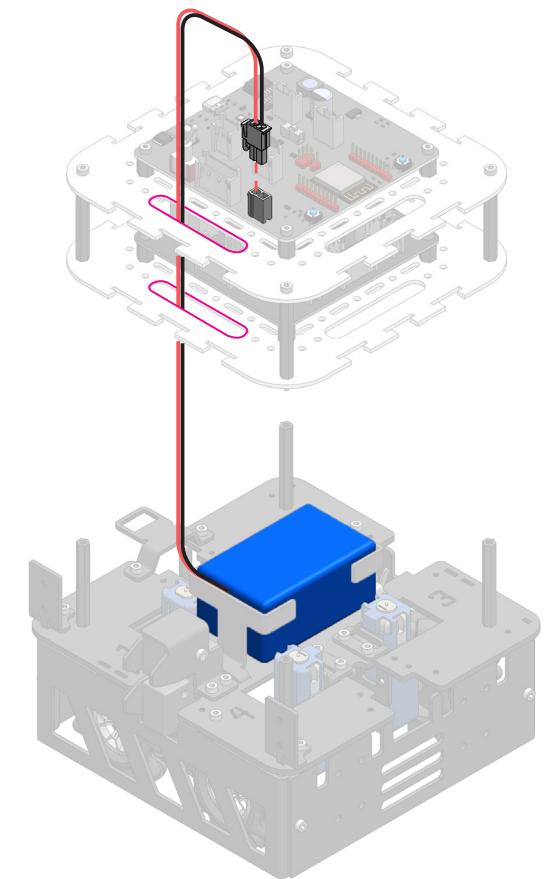
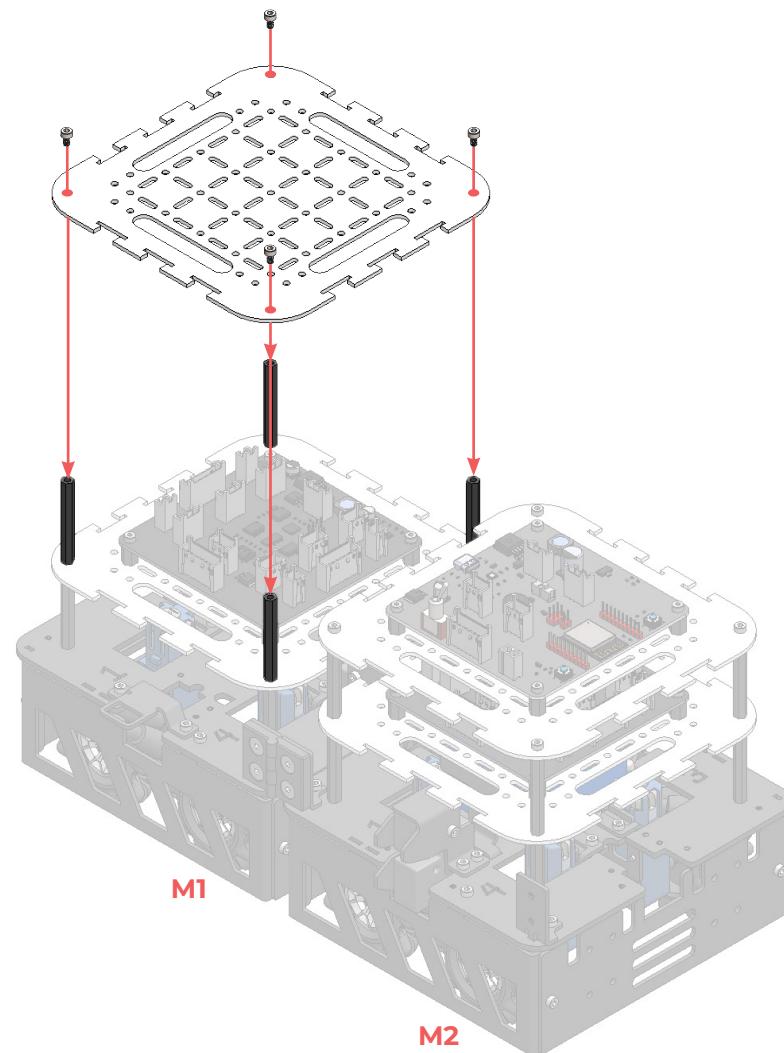
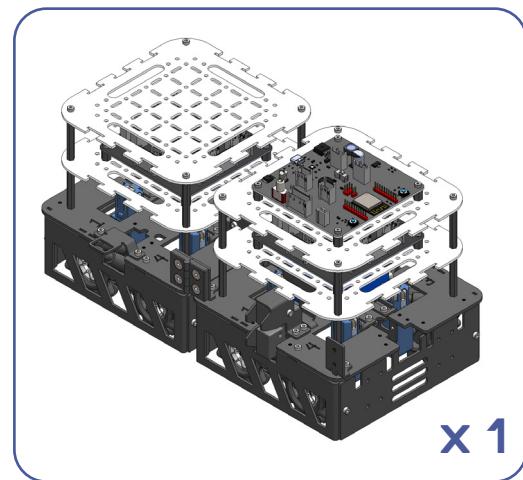
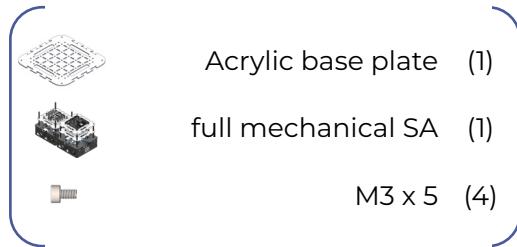
## B9 (masterboard e-tray onto main assembly)



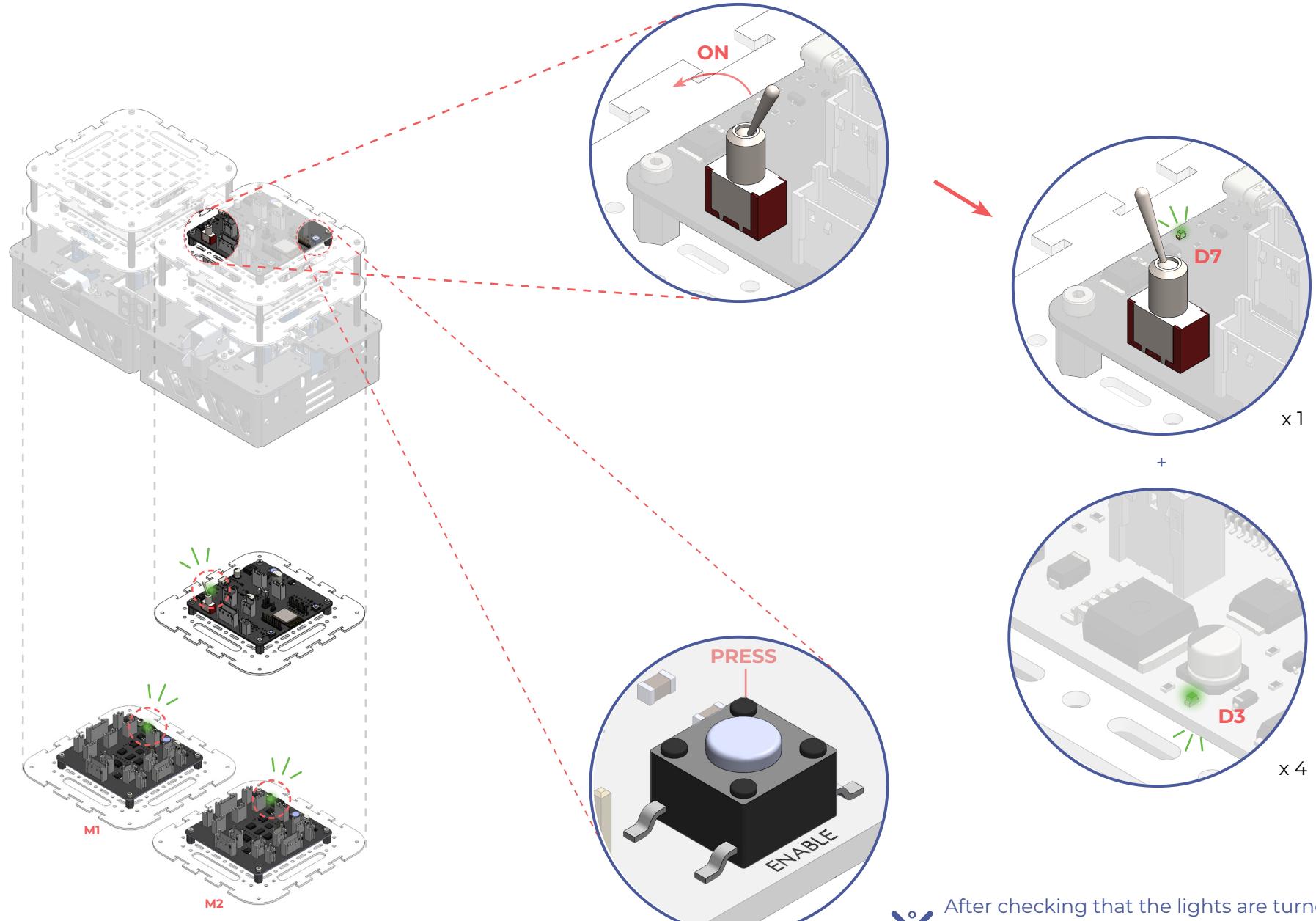
Align the header to slaveboard connector on the masterboard to face the side connecting Motor 1 and 4

Opening to pass wire through

**B10** (attach acrylic covers & connect battery to masterboard)



## B 11 (check connection)



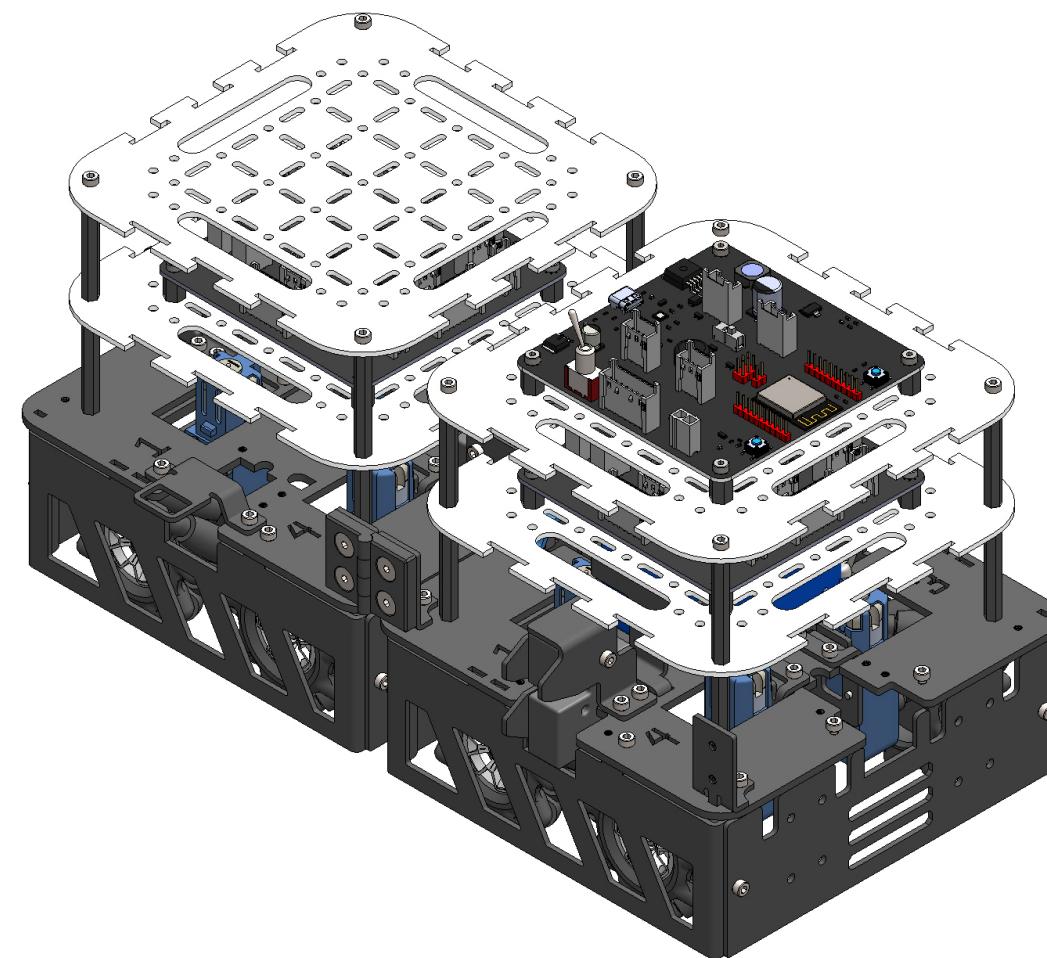
After checking that the lights are turned on,  
press on the enable button to activate the  
robot

B

electronic assembly completed

smorphi is ready!

next step: connect with app



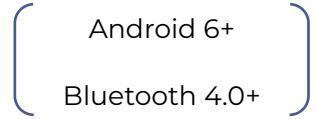


## 1. App Download.

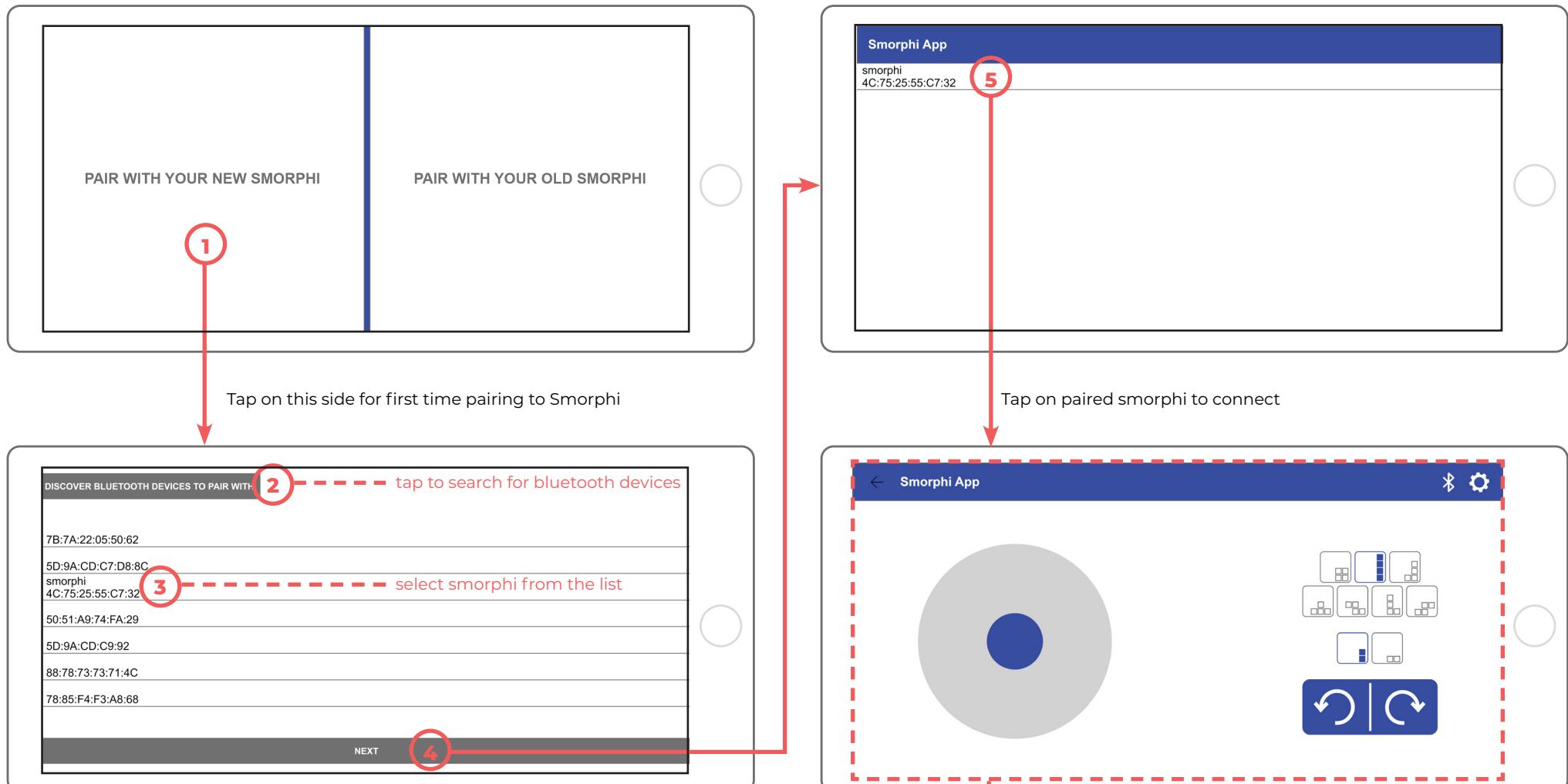


Not all devices are compatible now.

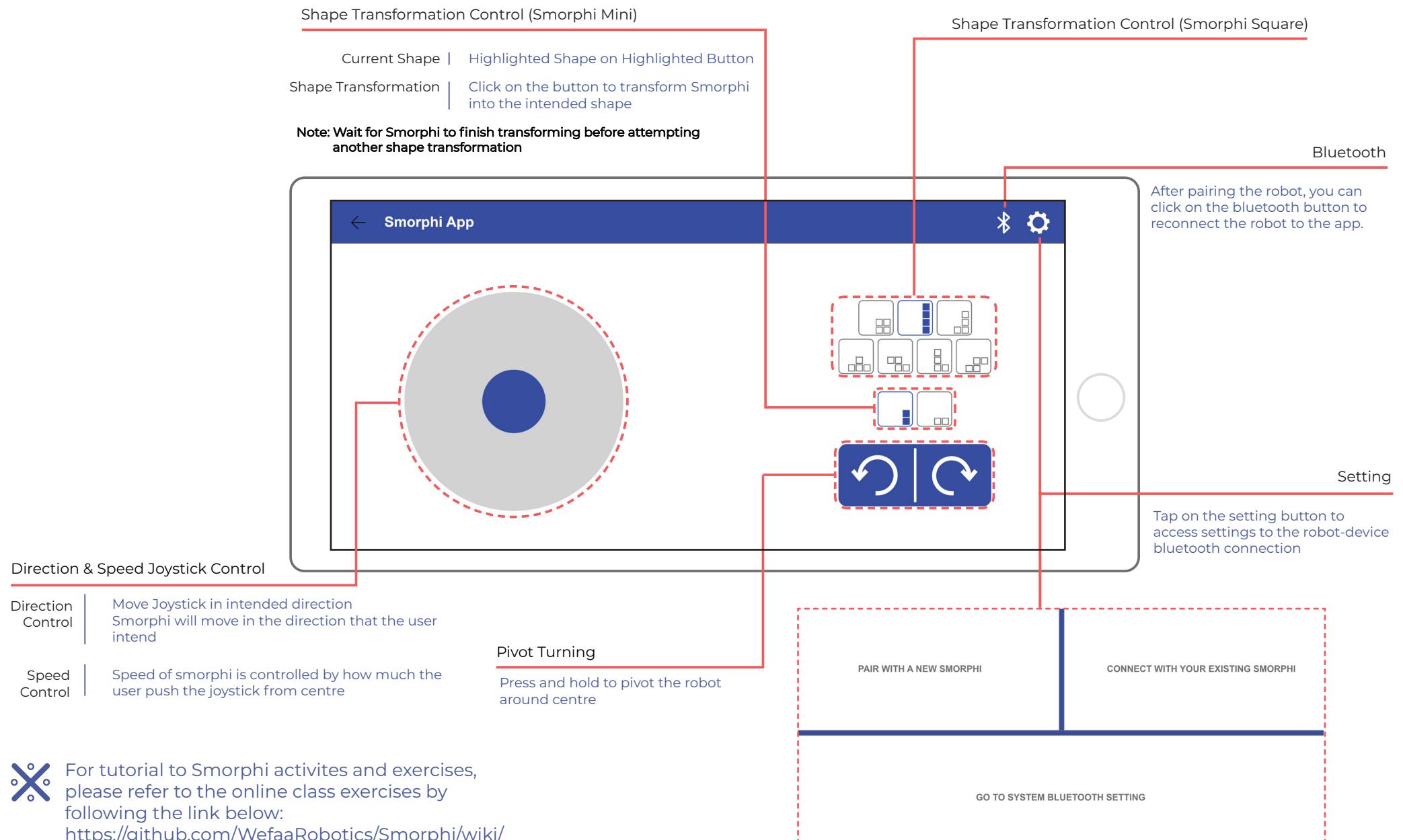
See the table below to check if your device is compatible with the Smorphi app.

Smorphi App Information	
<b>Available Platforms</b>	(      Android      )
<b>Download from</b>	(      Google Play      )
<b>App Icon &amp; Name</b>	 smorphi
<b>System Requirements</b>	 OS Requirements
	Android 6+ Bluetooth 4.0+

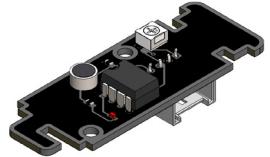
2. Bluetooth Connection. Turn on Smorphi and the Bluetooth of your smart device. Tap on Smorphi app icon to launch application.



### 3. Smorphy controls dashboard guide.



# ( sensors )



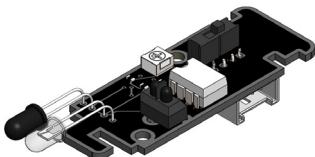
**sound sensor** (x1)

Sound sensor measures volume of sound. Onboard potentiometer\* can be used to tune the range of sensing. Possible applications: sound-triggered shape transformation or sound-triggered locomotion.



**temperature sensor** (x1)

Temperature sensor measures surrounding temperature, with a range of -55°C to 125°C.



**IR sensor** (x3)

IR sensors comes with 2 different modes, toggled by the switch onboard the sensor itself. One IR is front-facing and can be used to detect obstacles ahead. The other IR faces the ground and can be used for path tracking.

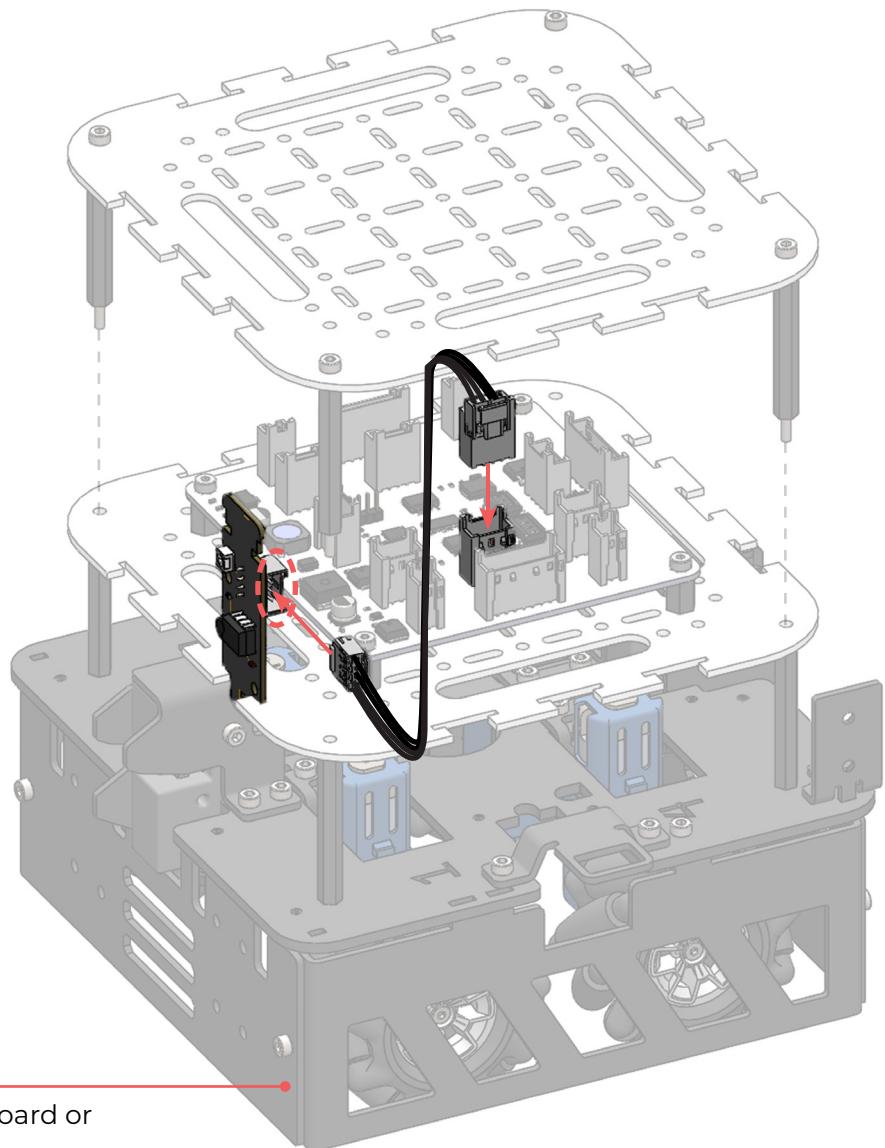
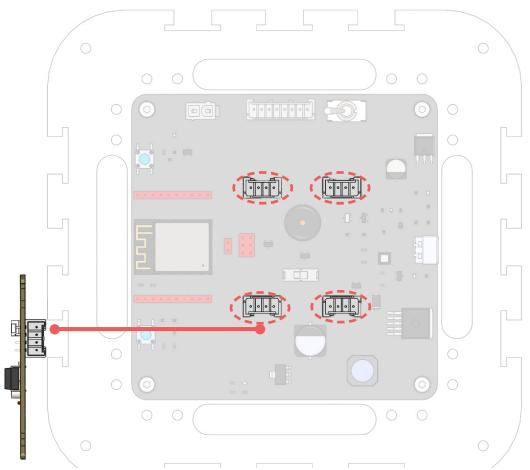
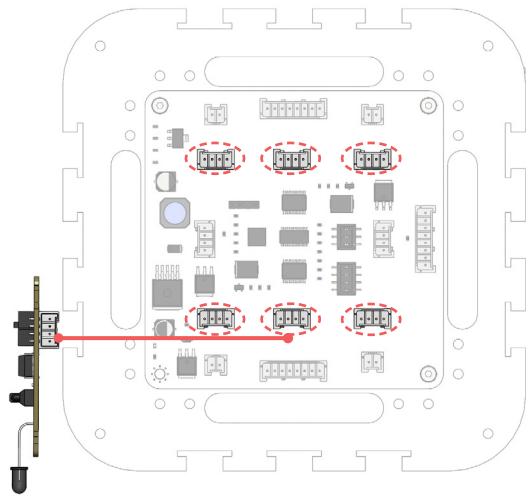


For sensor related activities and implementation, please refer to the online class exercises by following the link below:  
<https://github.com/WefaaRobotics/Smorphi/wiki/Robot-Exercises>



Tutorial on how to operate the potentiometer can be found by following the link below:  
<https://github.com/WefaaRobotics/Smorphi/wiki/Exercise-6>

# ( sound/IR sensor wiring )



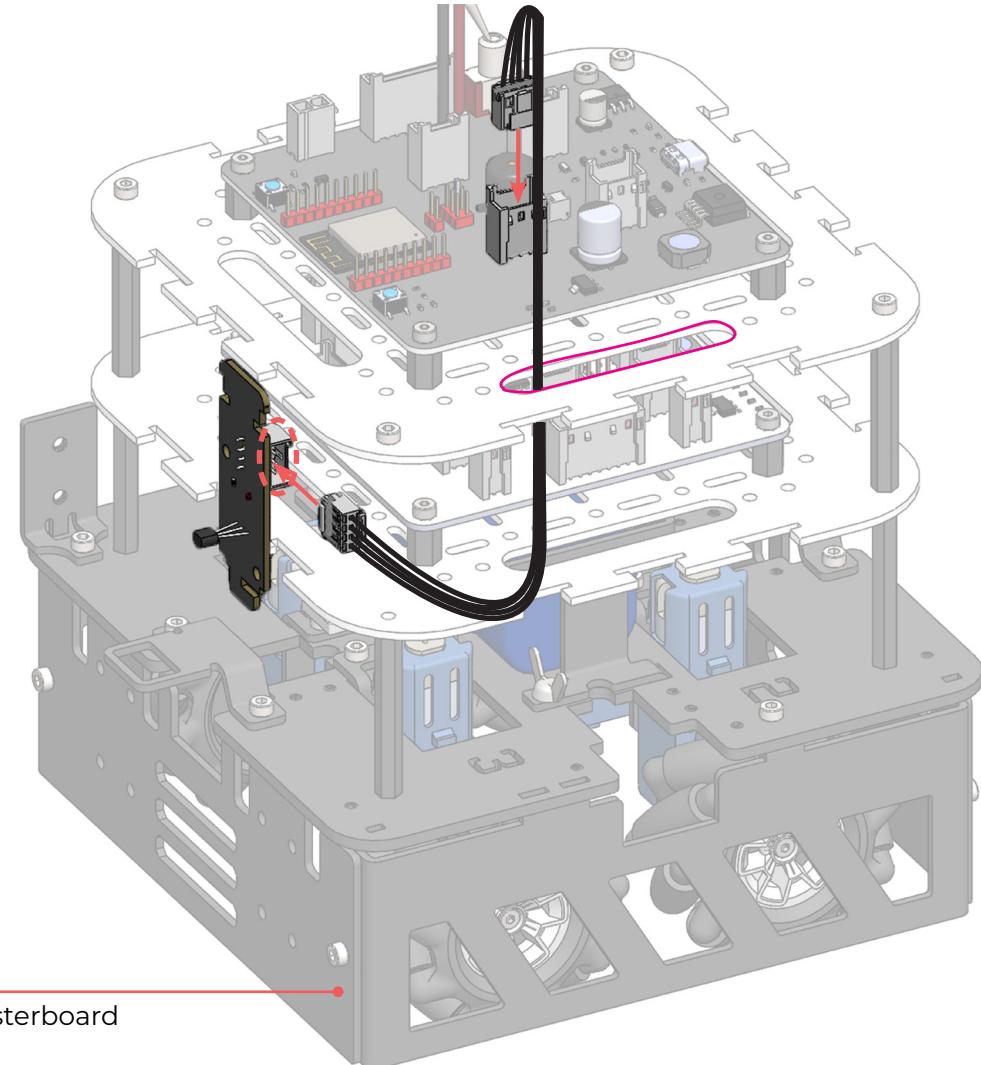
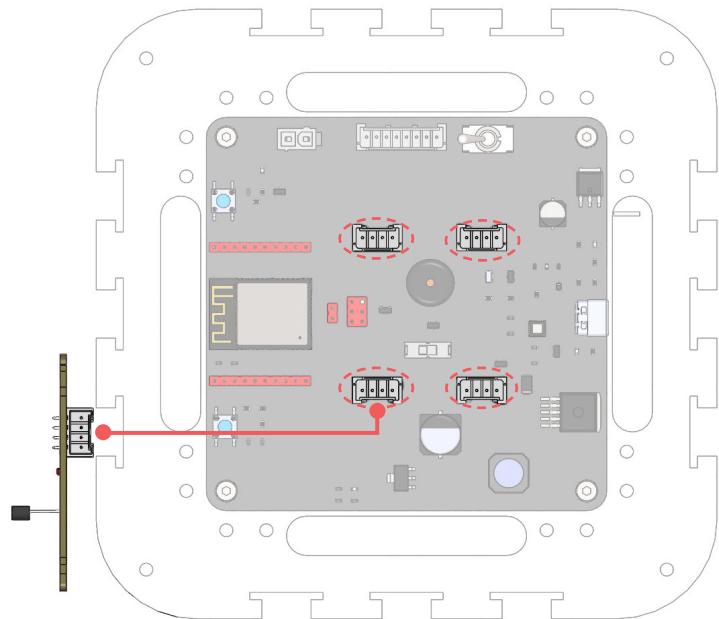
Module 1 or 2

Connect to masterboard or  
slaveboard



Sound/IR sensor can be connected to any of the 6 sensor ports on the slaveboard (top) or any of the 4 sensor ports on the masterboard (bottom).

# ( temperature sensor wiring )



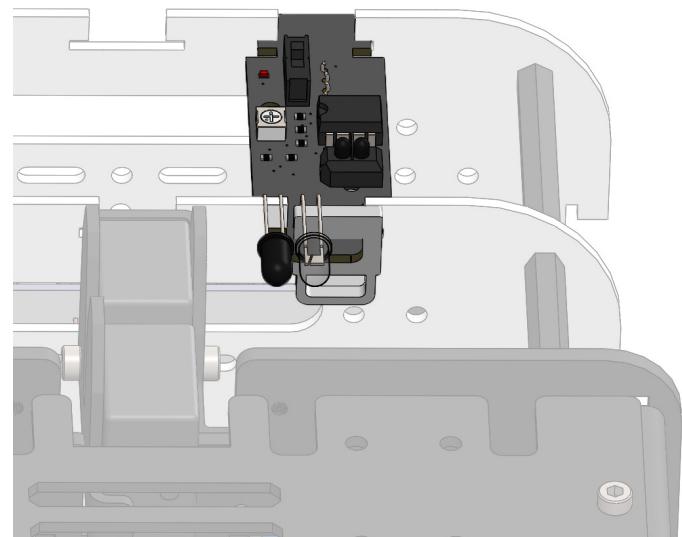
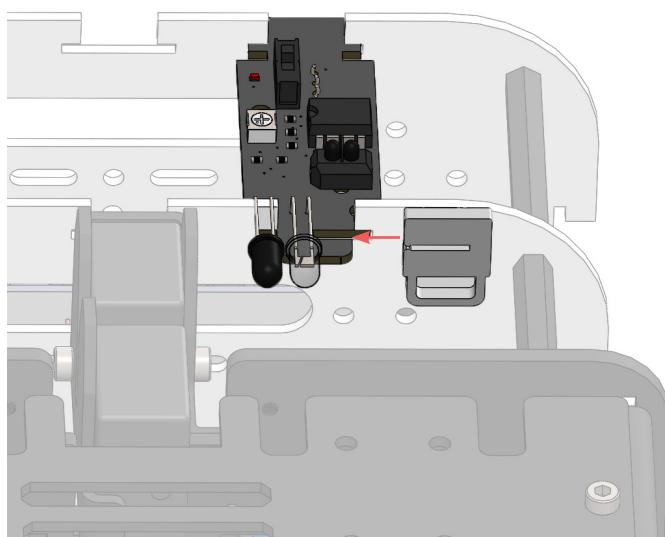
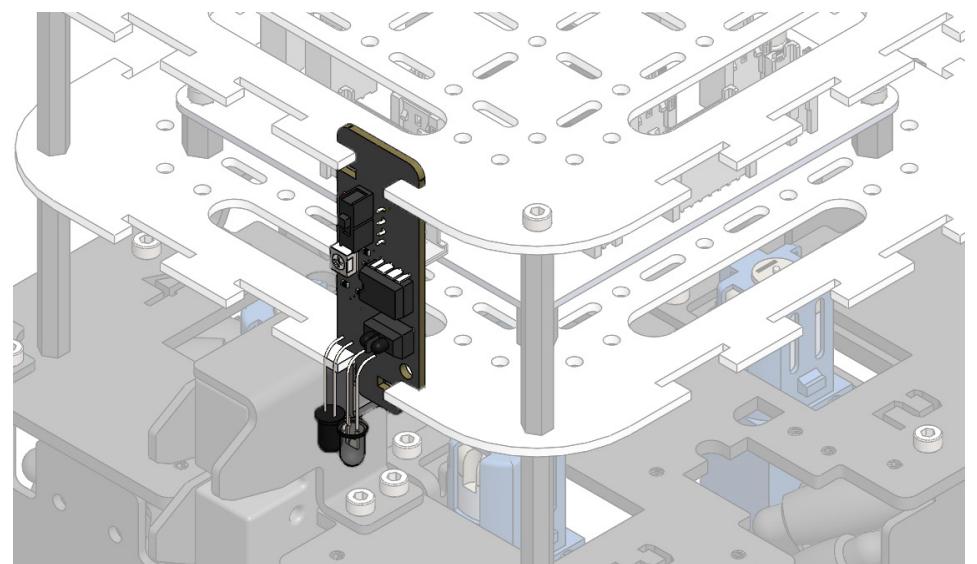
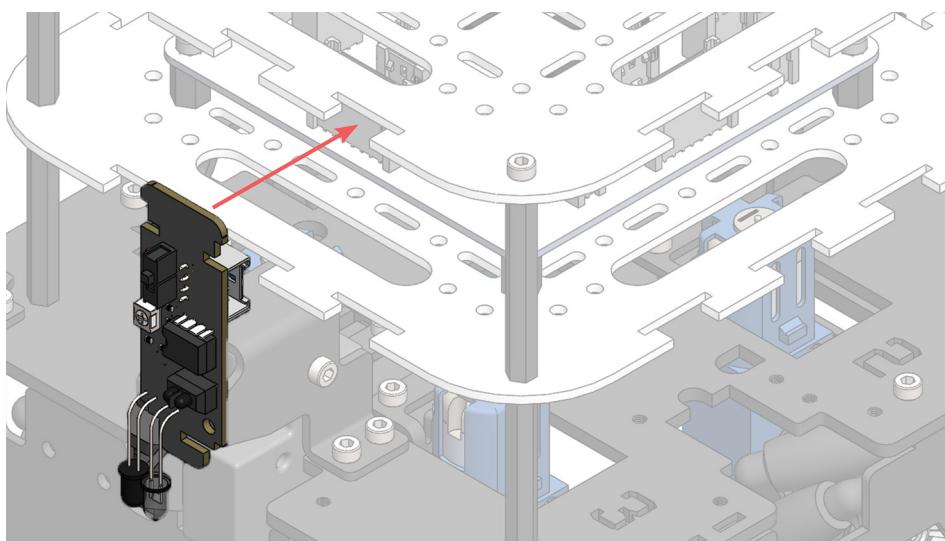
Module 2  
Only connect to masterboard

34

Temperature sensors can only be connected to any of the 4 sensor ports on the masterboard.

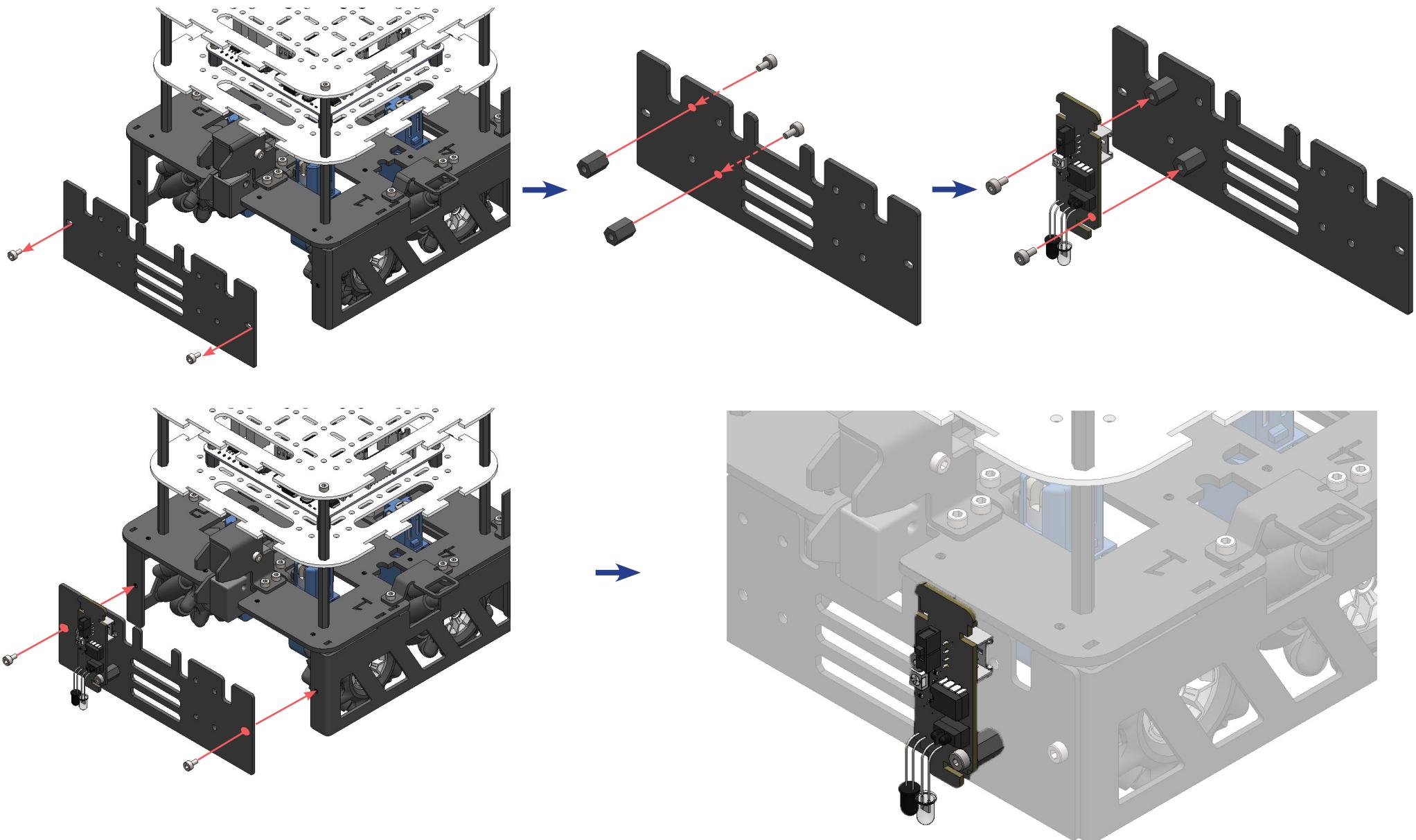
Opening to pass wire through

## ( sensor position 1 )



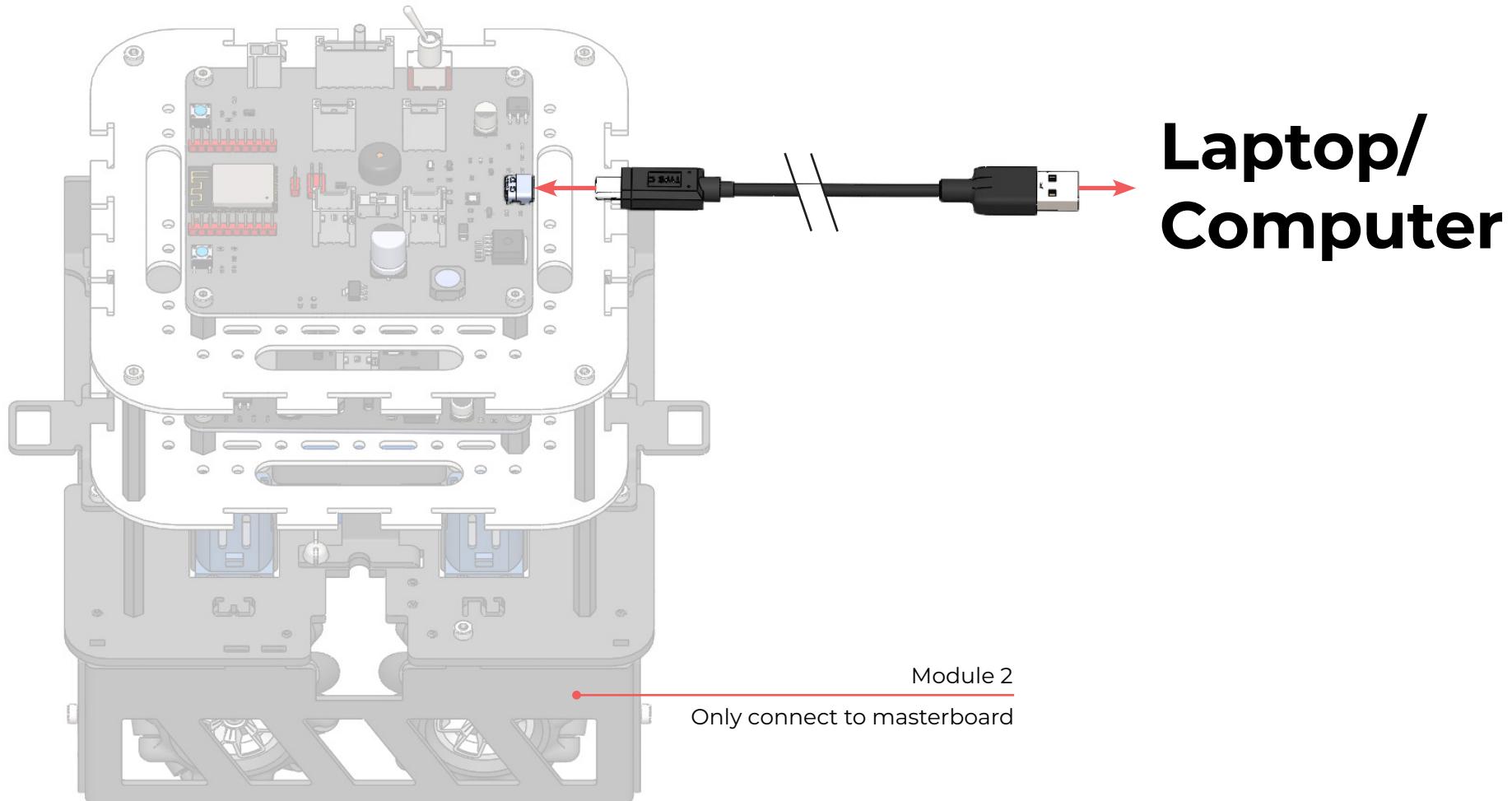
Sensors can be secured to the robot using  
the sensor lock provided

## ( sensor position 2 )



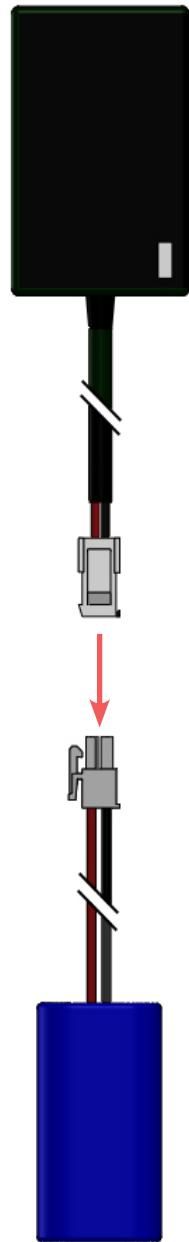
Sensors can also be attached at the skirt panel  
of the robot

( connect to laptop )

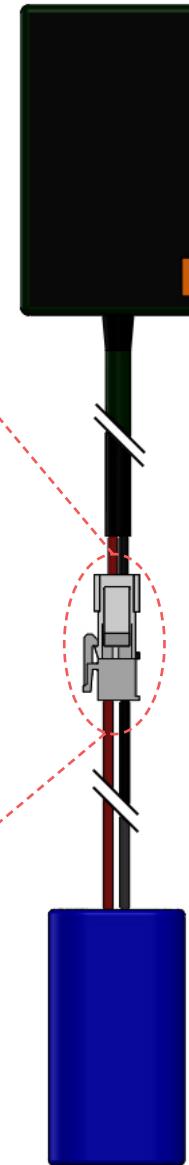
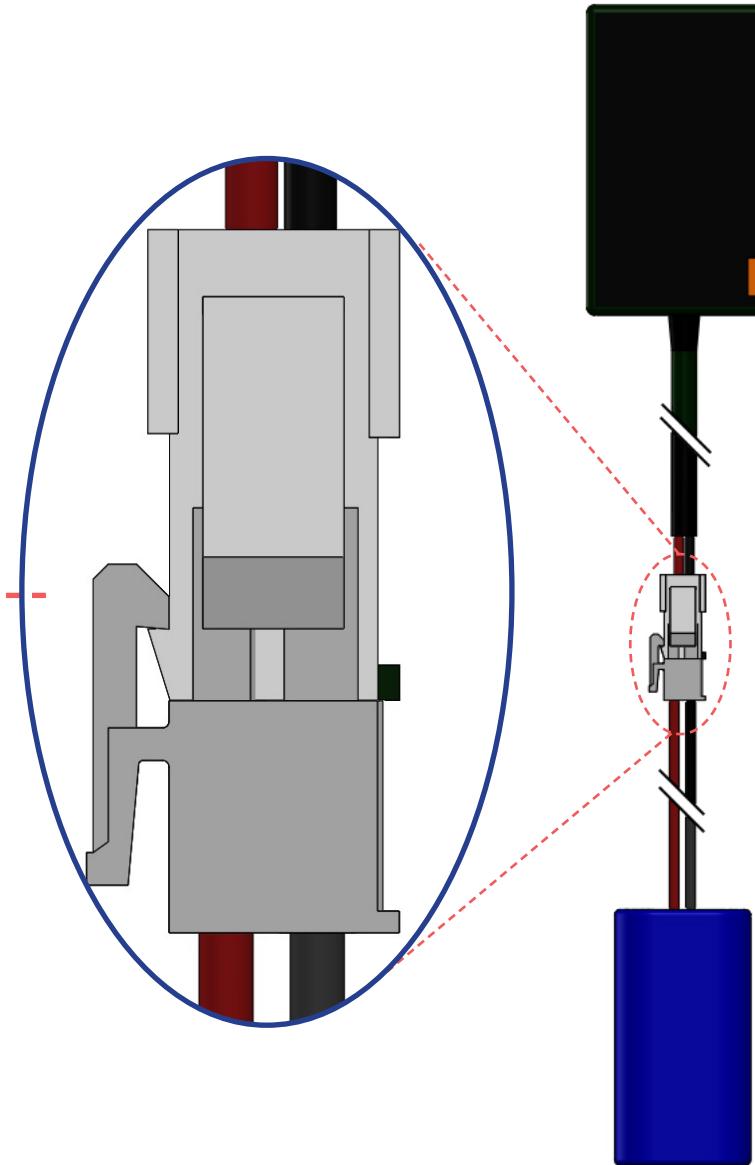


Plug in the USB-C cable as shown above to connect the masterboard to the computer.  
It allows us to upload our code from our computer onto the masterboard.

# ( charging )



Make sure the both connector is connected by the latch



When battery is charging, an orange light will be shown on the charger. Once battery is fully charged, a green light will be shown

