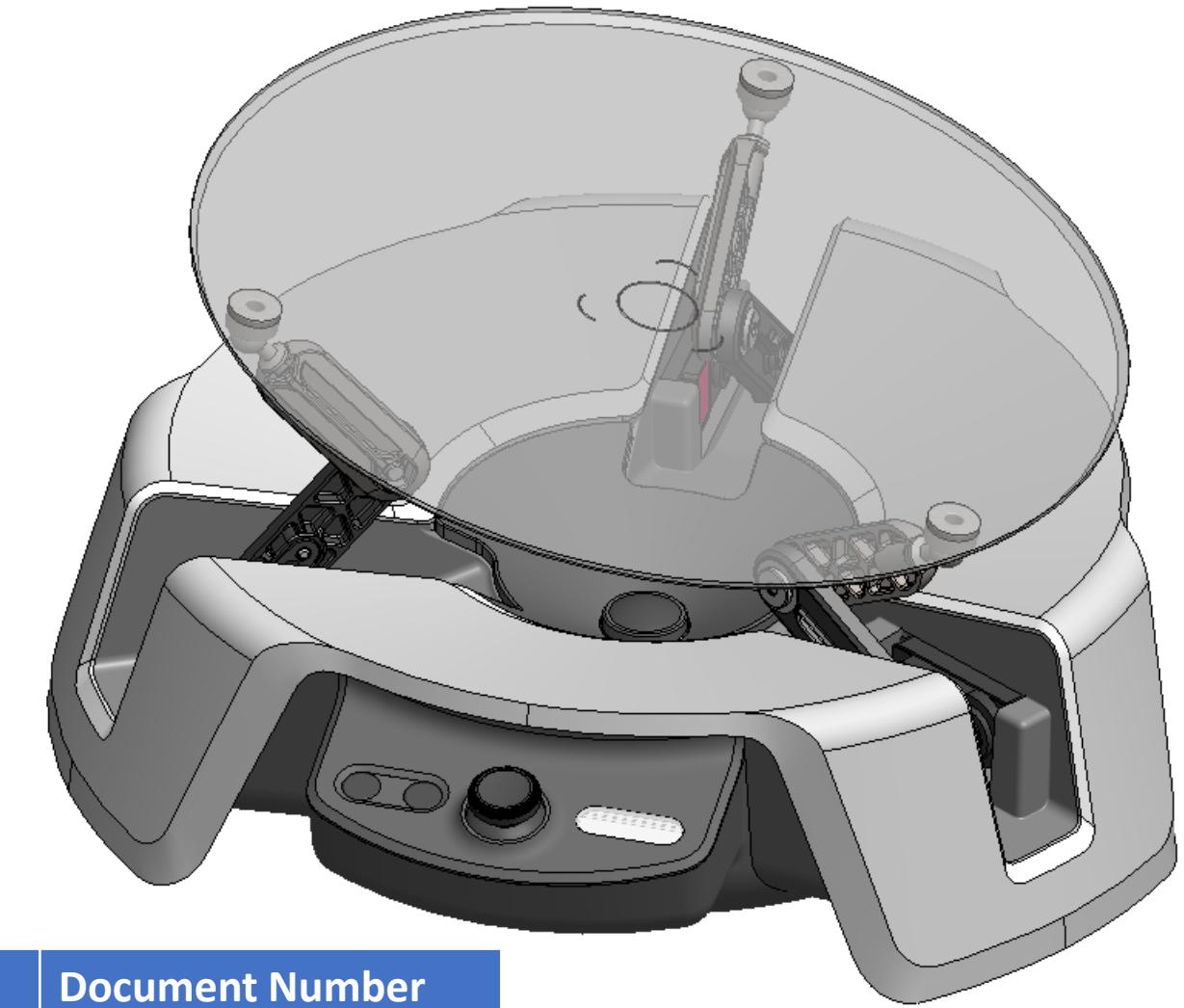


# 03252-DOC-INS01 - MOAB V2 ASSEMBLY INSTRUCTIONS - REV 03

## Revision History:

Rev	Description	Date
01	Formal start to document tracking. Reorder of camera and SD card steps.	6/30/20
02	Moved reference for board test procedure to after Control Panel Assembly. (pg 43) Added referenced document number (pg 1, 43, 70, 72), note clarifying UI sub-assembly and control panel assembly are the same (pg 34)	7/2/20
03	Switching magnet plate adhesive from epoxy to 3M VHB (pg 20, 21, 22). Cutting off snaps and adding screw to camera attachment (pg 49)	7/28/20



## Ref Documents:

Rev	Title	Document Number
03	Moab Test Procedure	03252-DOC-INS02

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# Drive Types and Torques

- T8, 4in-lb
- T10, 4in-lb and 7in-lb
- 1.5mm Hex, 2in-lb
- 3mm Hex, 12in-lb
- Phillips, 3in-lb



# Table of Contents

- Arm Assembly (QTY: 1500)
- Servo Motor Pre-Process (QTY: 1500)
- Servo Arm Alignment (QTY: 1500)
- Servo Channel Assembly (QTY: 1500)
- Plate Assembly (QTY: 500)
- Top Cover Assembly (QTY: 500)
- Fan Pre-Process (QTY: 500)
- Board Test Pre-Process (QTY: 500)
- Control Panel Assembly (QTY: 500)
- Raspberry Pi Heat Sinks (QTY: 500)
- Bottom Assembly (QTY: 500)
- Packaging (QTY: 500)



# Arm Assembly

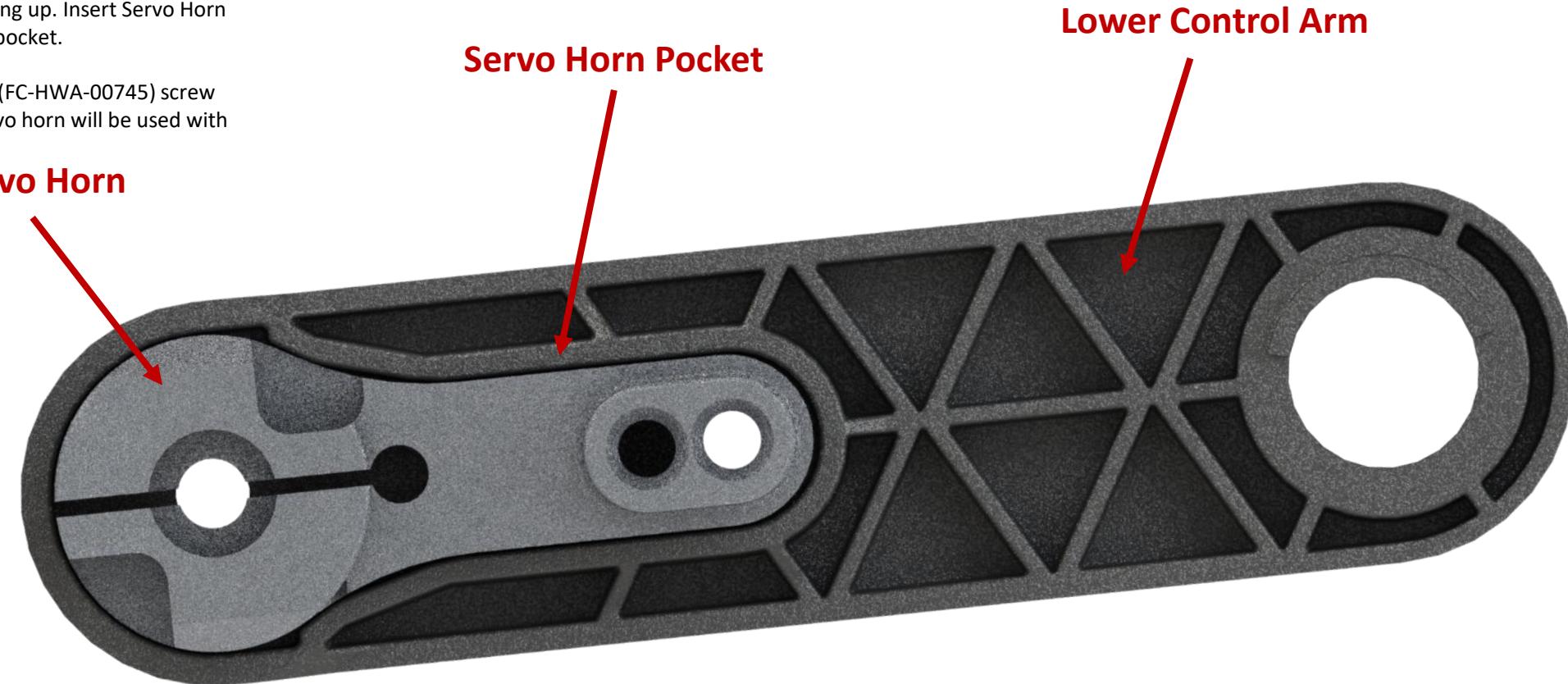
**NOTE:** This is repeated 3x per unit



## STEP 1

Place Lower Control Arm (FC-HWA-00586) with Servo Horn pocket facing up. Insert Servo Horn (FC-HWA-00584) into pocket.

Black Philips drive M3 (FC-HWA-00745) screw packaged with the servo horn will be used with the HDMI board



## STEP 2

While holding Servo Horn in place, flip the Lower Control Arm over and fasten with a M3 x 8mm button head machine screw (FC-HWA-00593). Tighten to 4 in-lb.

Apply light coat of Loctite 248 (FC-HWA-00747) to screw threads.

Avoid Loctite contacting plastic parts.



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### STEP 3

Press the Bearing (FC-HWA-00587) into pocket in Lower Control Arm.



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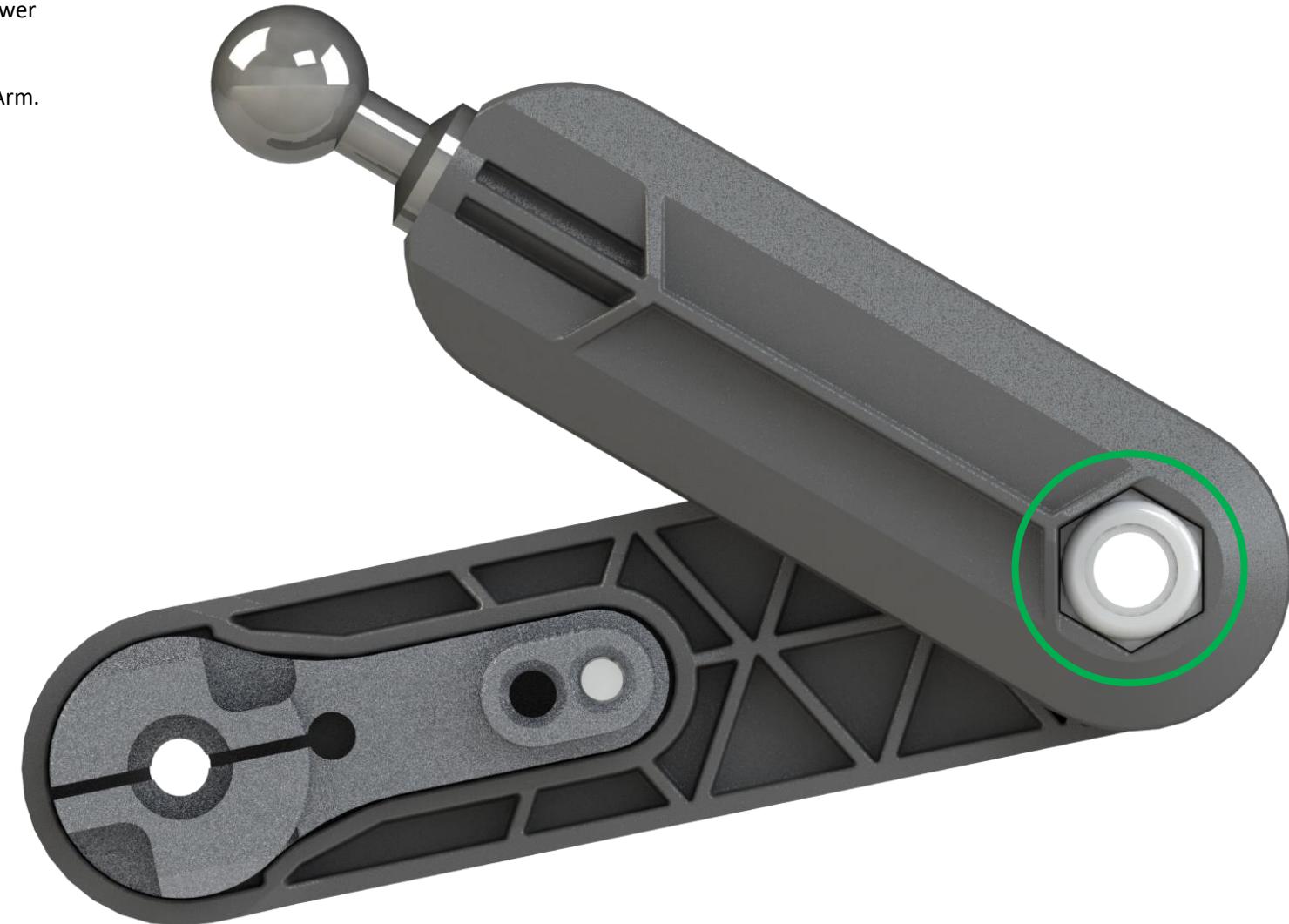


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## STEP 4

Align holes in Upper Control Arm (FC-ASM-00290) and Lower Control Arm.

Insert M5 Nylock Nut (FC-HWA-00589) in Upper Control Arm.



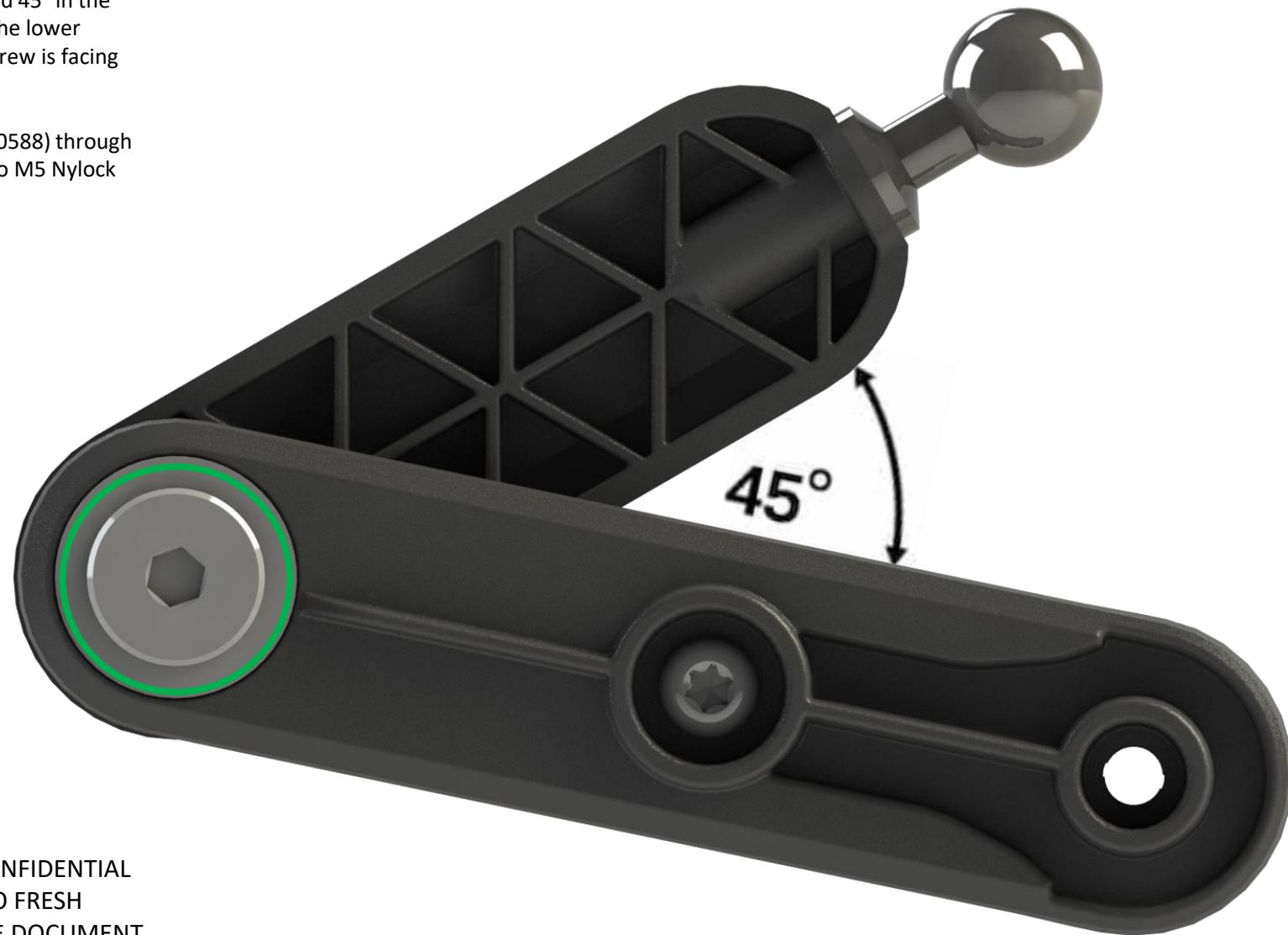
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## STEP 5

Ensure upper control arm is around 45° in the counterclockwise direction from the lower control arm when the Shoulder Screw is facing up.

Insert Shoulder Screw (FC-HWA-00588) through Lower Control Arm and thread into M5 Nylock nut.

Tighten to 12in-lb.



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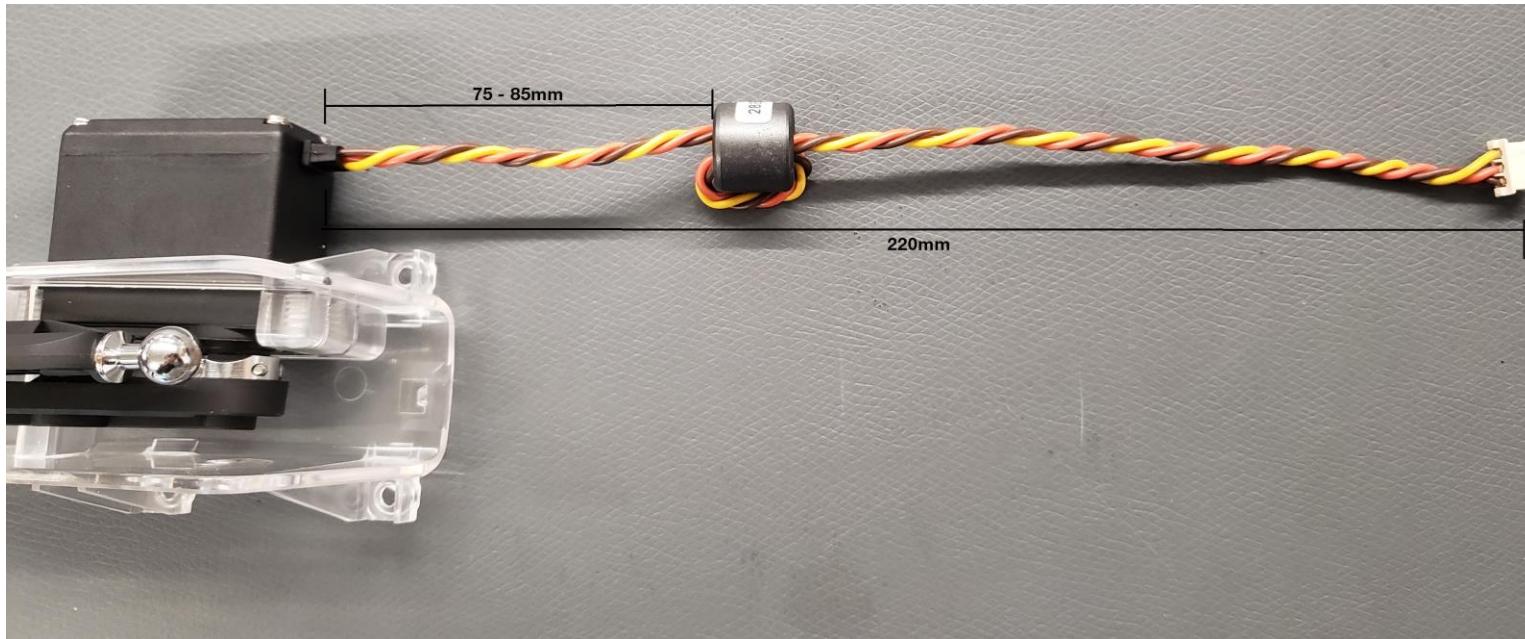
# Servo Motor Pre-Process

**NOTE:** This is repeated 3x per unit

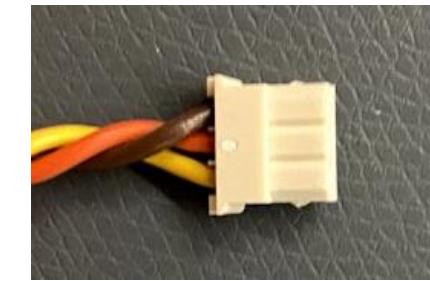
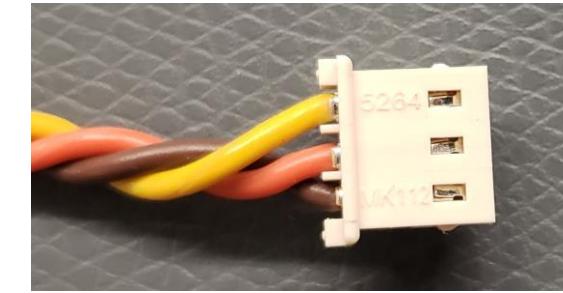


## Servo Motor Pre-Process

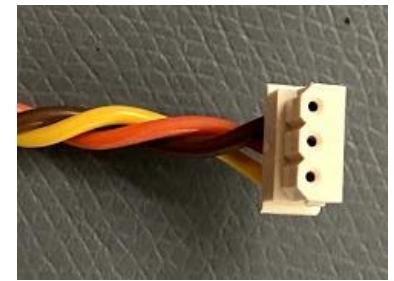
1. Cut off existing connector
2. Twist wires to 1.3-1.6 twists/in
3. Add ferrite (FC-HWA-00758) as seen below
4. Cut wires to 220mm
5. Crimp on connector following the color pattern below (FC-HWA-00585 & FC-HWA-00757)



Top View



Bottom View



Front View

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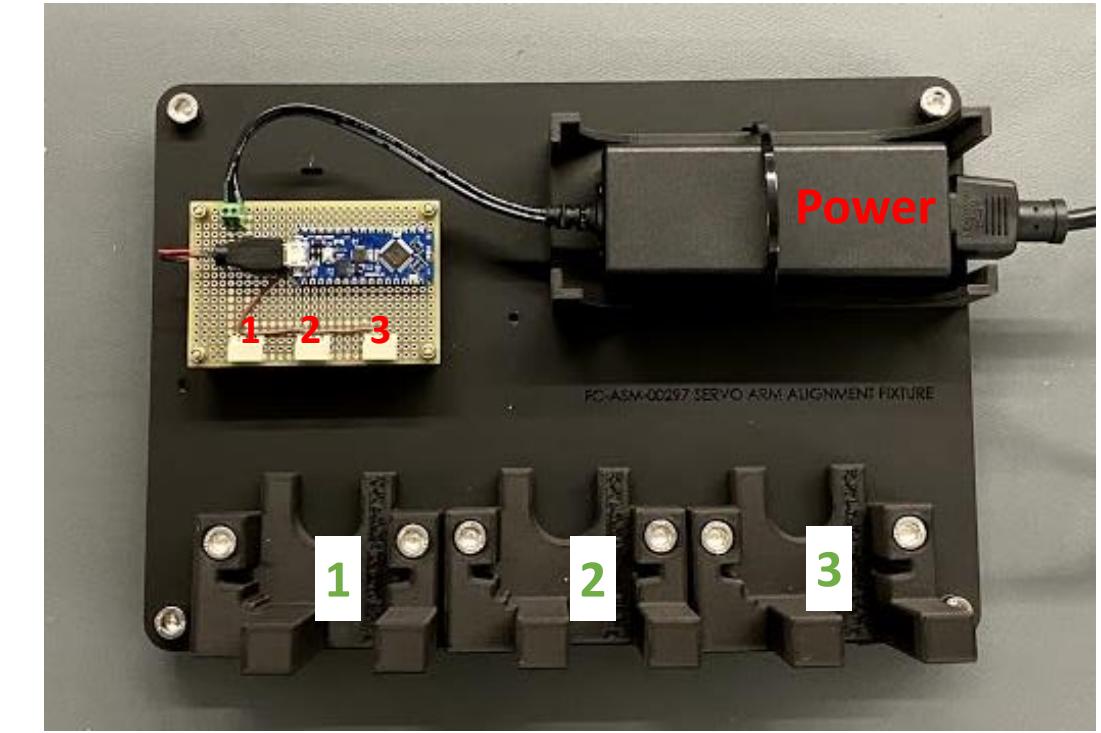
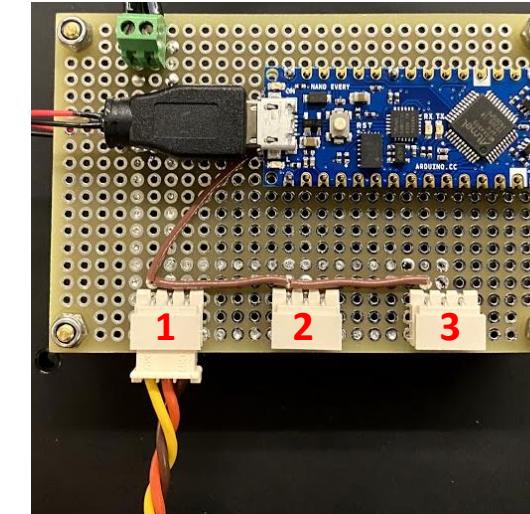
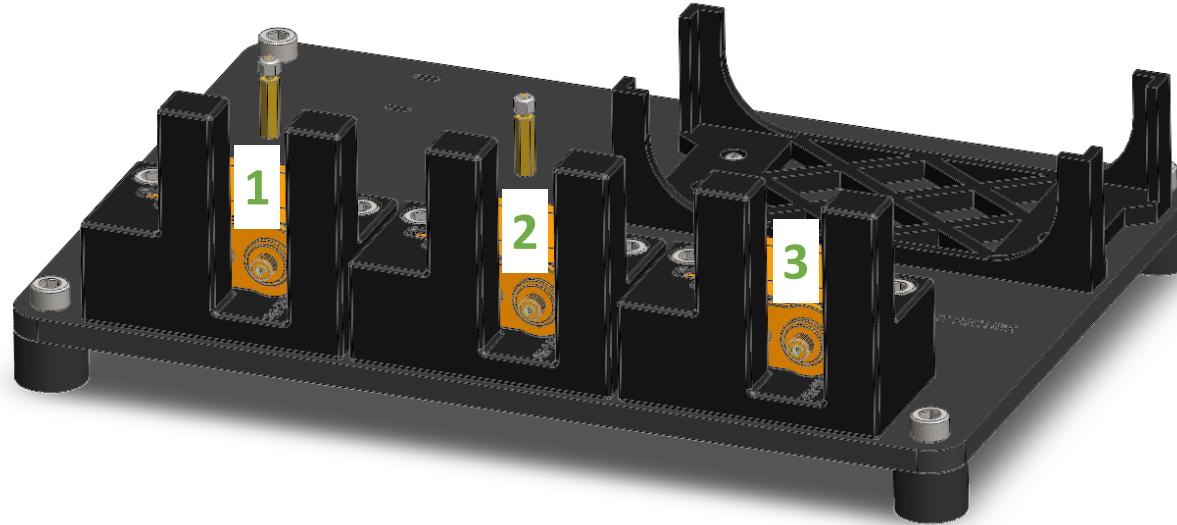


# Servo Arm Alignment

**NOTE:** This is repeated 3x per unit



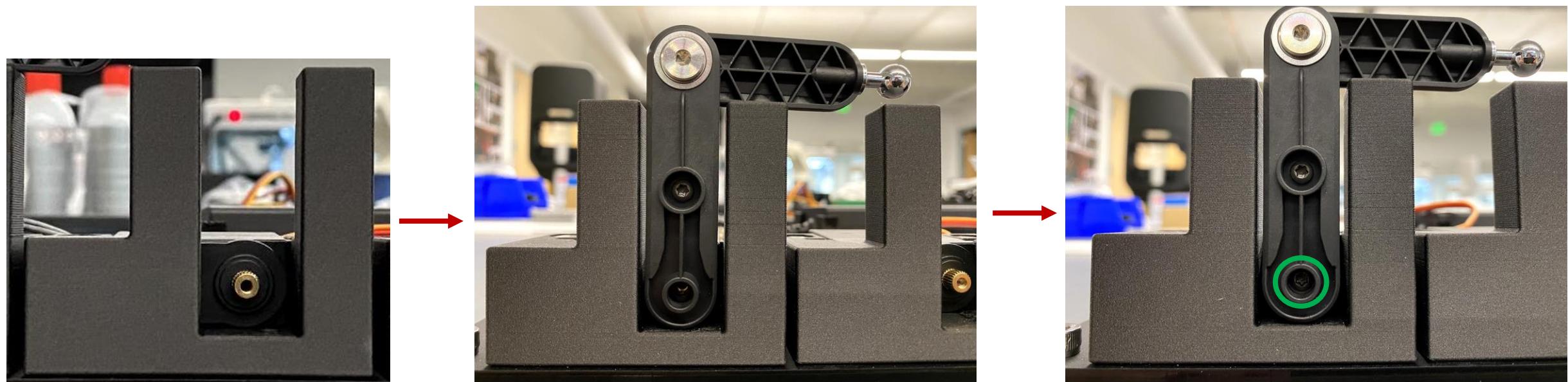
1. Ensure Servo Alignment Fixture is powered
2. Place a servo in each of the 3 servo slots in the Servo Alignment fixture (green numbers)
3. Attach each of the three servos to their ports on the Arduino board (red numbers)



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4. Place fully assembled servo arm onto servo
5. Install M3 machine screw (FC-HWA-00593) with light coat of Loctite 248 (FC-HWA-00747) to attach servo arm assembly to servo (green circle). Note: Prevent Loctite from contacting any plastic material.
6. Tighten to 4 in-lb
7. Remove aligned servo from fixture



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# Servo Channel Assembly

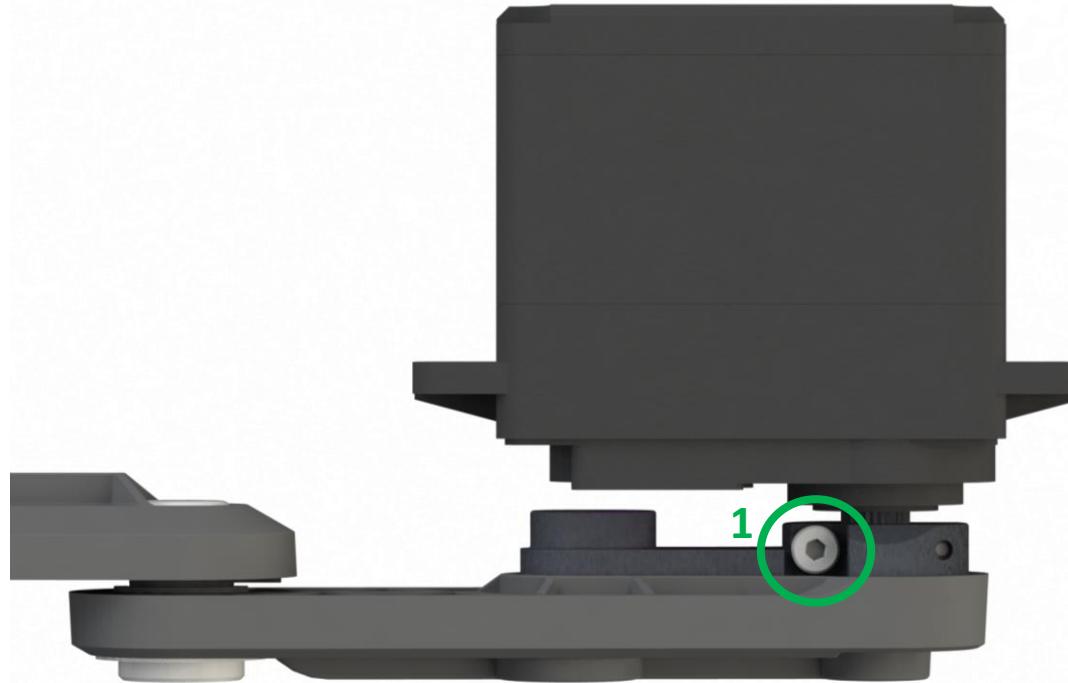
**NOTE:** This is repeated 3x per unit



## STEP 1

Apply light coat of Loctite 248 (FC-HWA-00747) to threads on each screw. Ensure Loctite does not contact plastic.

Tighten both M2 screws in servo horn to 2 in-lb



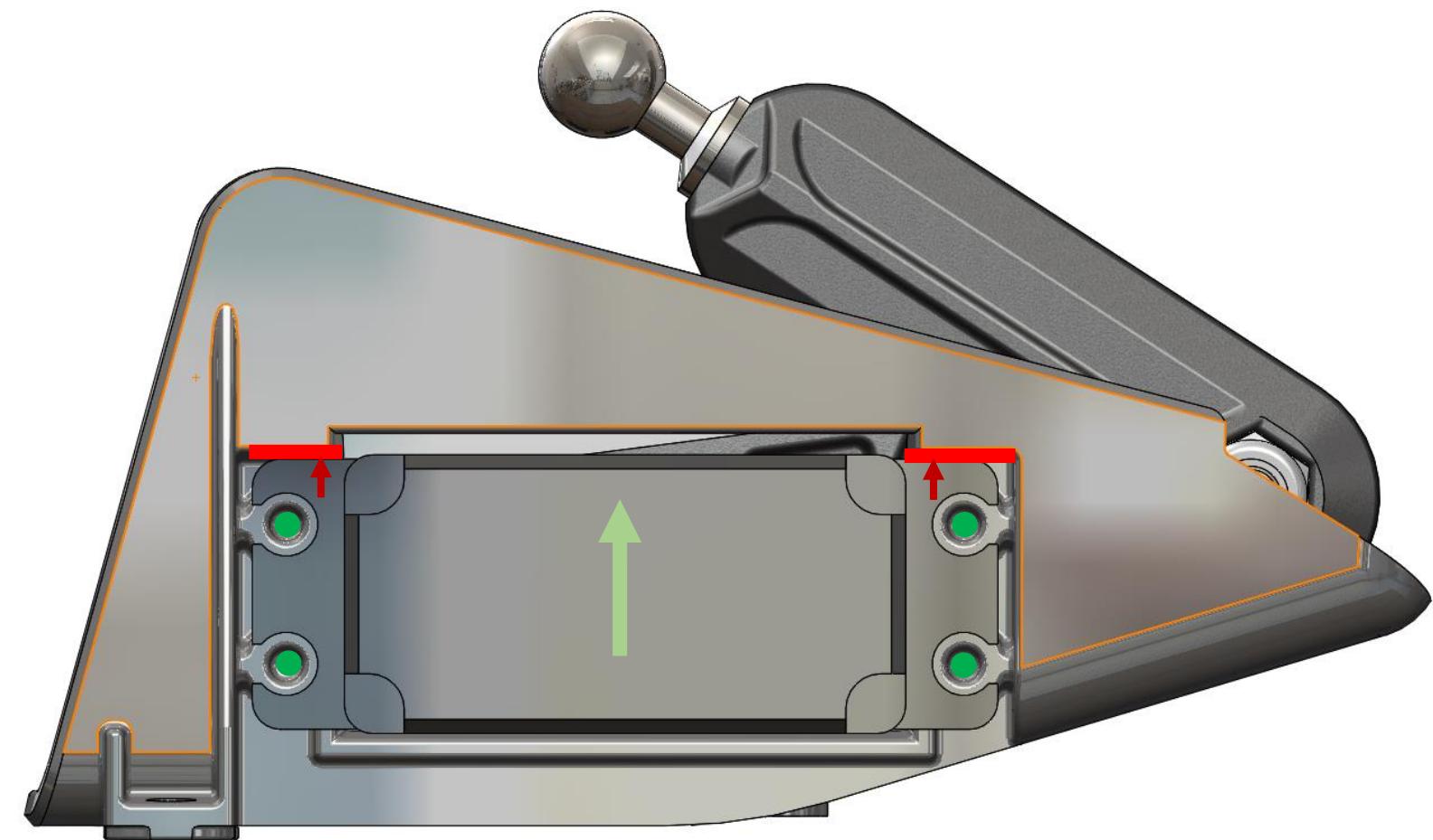
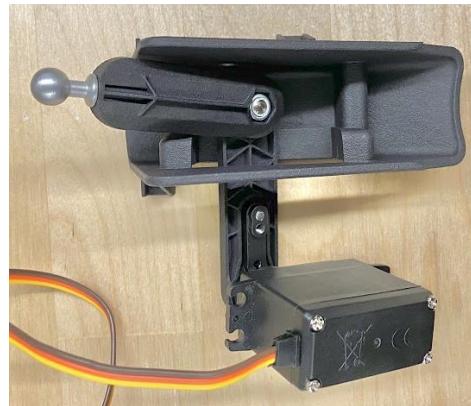
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## STEP 2

Bring Arm assembly through pocket in Servo channel and mate faces of Servo to Servo Channel, aligning mating holes.



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Note: Push servo up (in the direction of the green arrow) to ensure the servo contacts the servo channel along the red lines

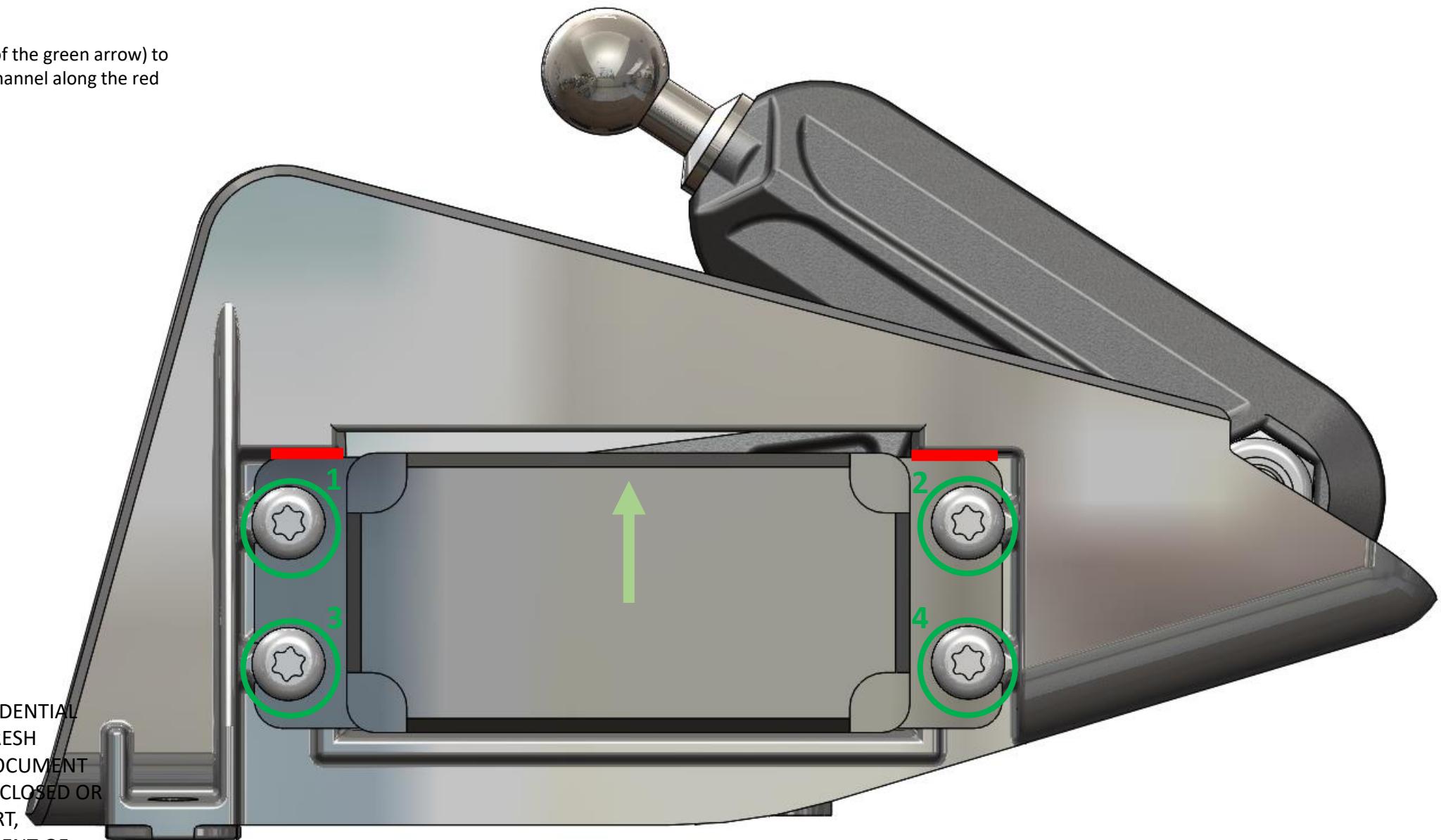


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### STEP 3

Fasten Servo to Channel with QTY 4 M3 x 8 Plastite screws (FC-HWA-00744). Tighten to 7 in-lb.

Note: Hold servo up (in the direction of the green arrow) to ensure the servo contacts the servo channel along the red lines



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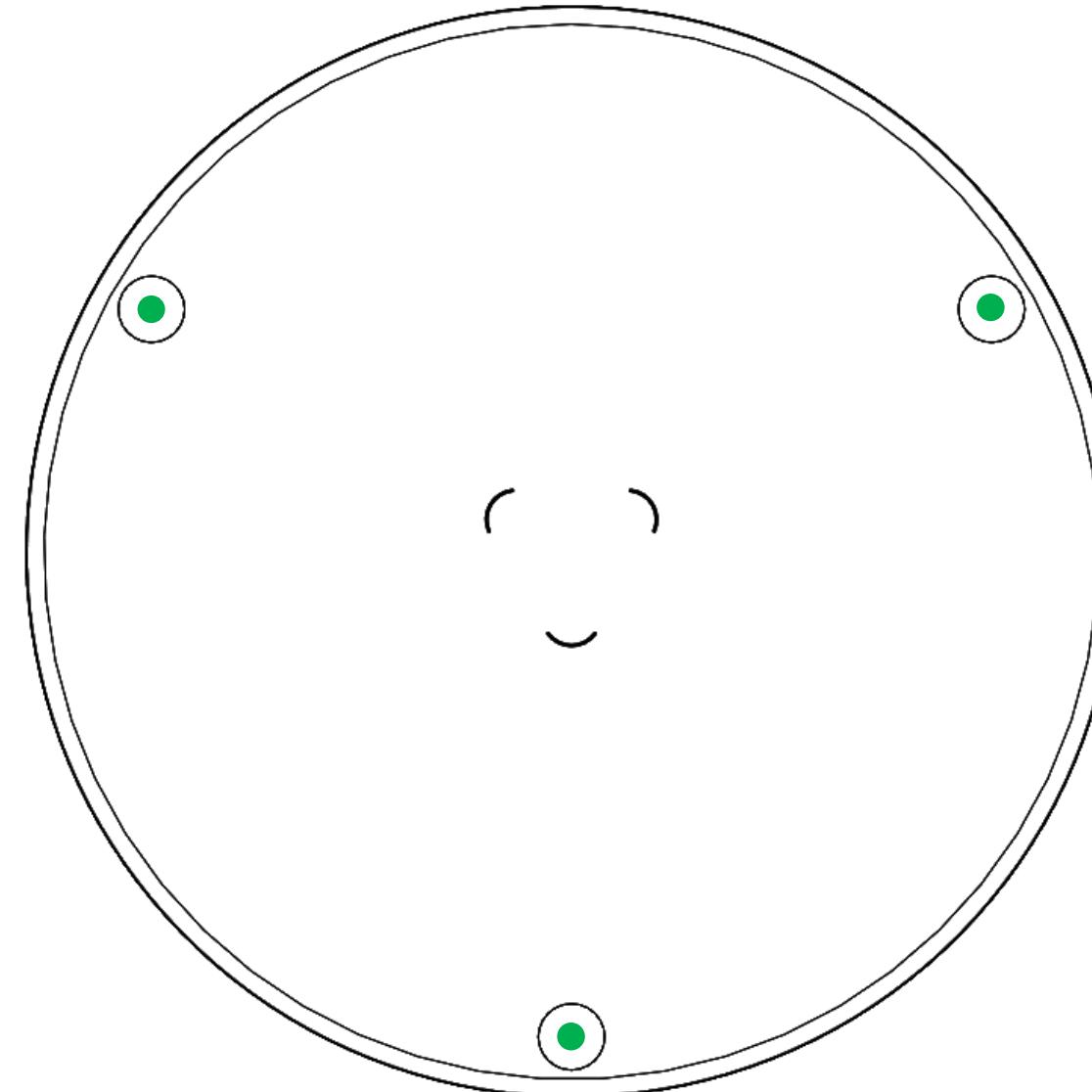
# Plate Assembly



## STEP 1

Apply a small amount of isopropyl alcohol to the three counterbore pockets in the balance plate (FC-HWA-00553) and the flat sides of each magnet (FC-HWA-00552). Wipe them clean and ensure there is no dust, lint, or debris on either surface.

**Flat Side**



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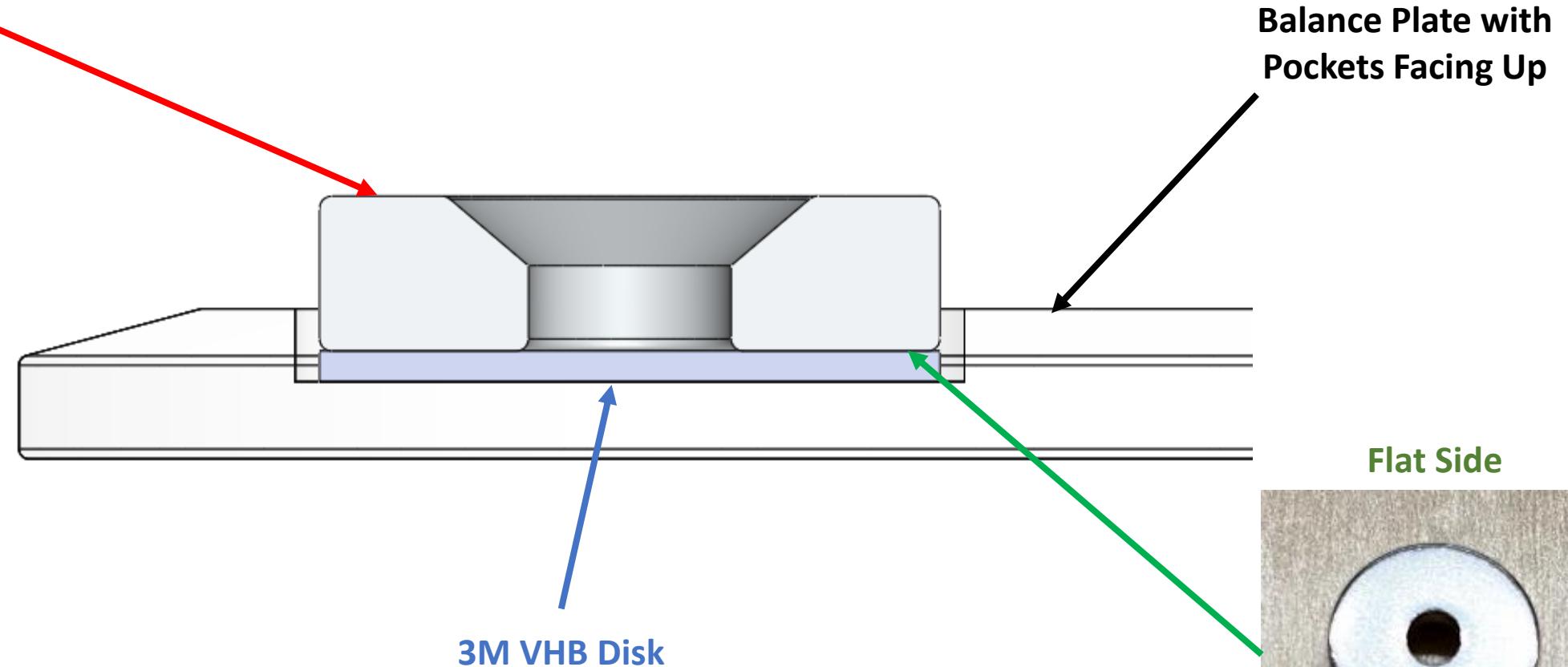


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## STEP 2

Adhere 3 3M VHB Disks (FC-HWA-00824) to the flat sides of 3 magnets (FC-HWA-00552)

### Countersunk Side



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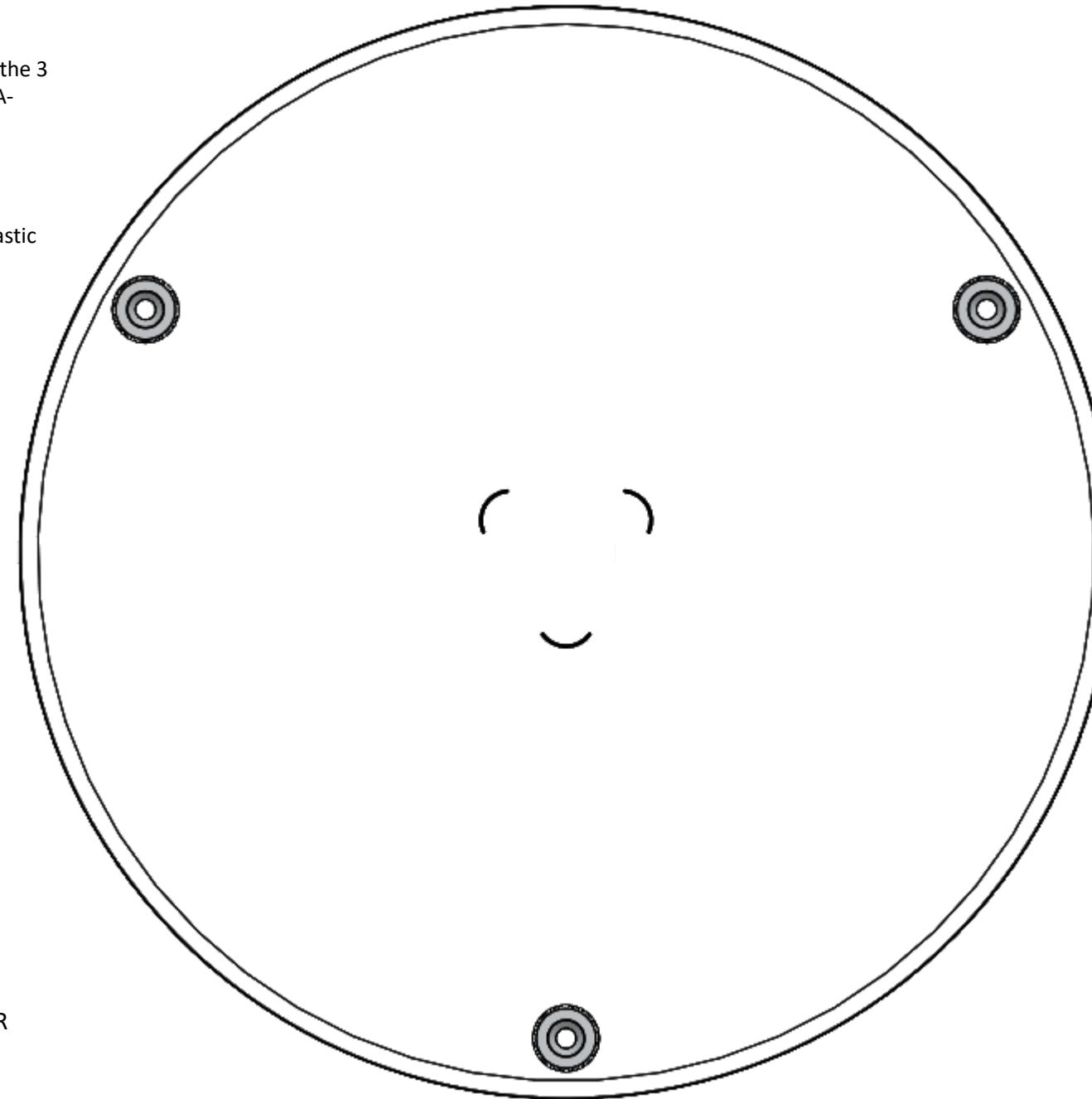
## STEP 3

Press each magnet backed with 3M VHB Disk into the 3 counterbore pockets in the balance plate (FC-HWA-00553)

Ensure countersunk side is facing up.

Balance Plate Assembly will be packaged in the plastic bag that the Top Cover came in.

### Countersunk Side



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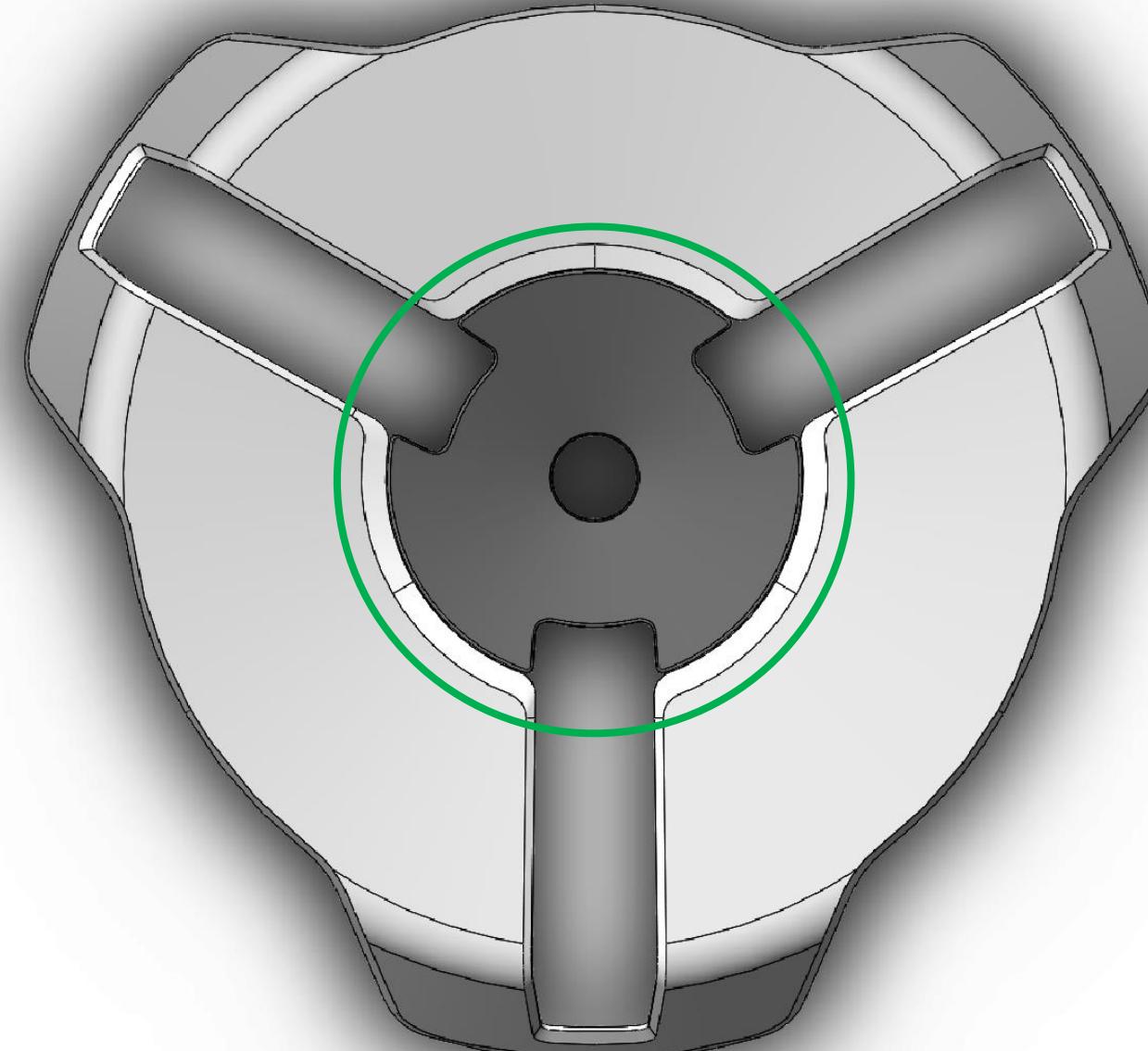
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# Top Cover Assembly



Snap Closeout Cone (FC-HWA-00551) onto Top Cover (FC-HWA-00550).

Ensure snaps are engaged between the two parts. This can require a lot of force.



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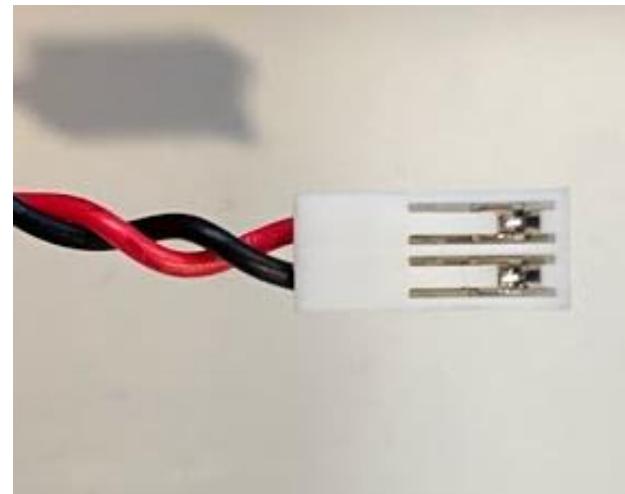
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# Fan Pre-Process

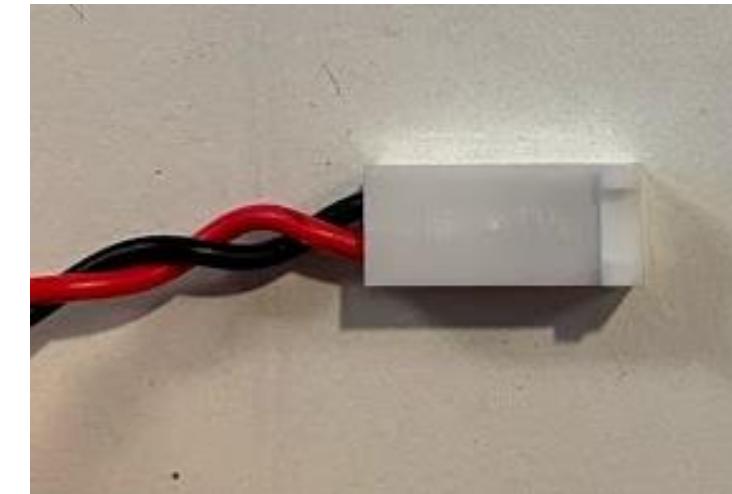


## Fan Pre-Process

1. Twist wires to 1.5-2 twists/in
2. Cut wires to 70mm
3. Crimp on connector (FC-HWA-00571 & FC-HWA-00572) following the color pattern below



Bottom View



Top View

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# Board Test Pre-Process

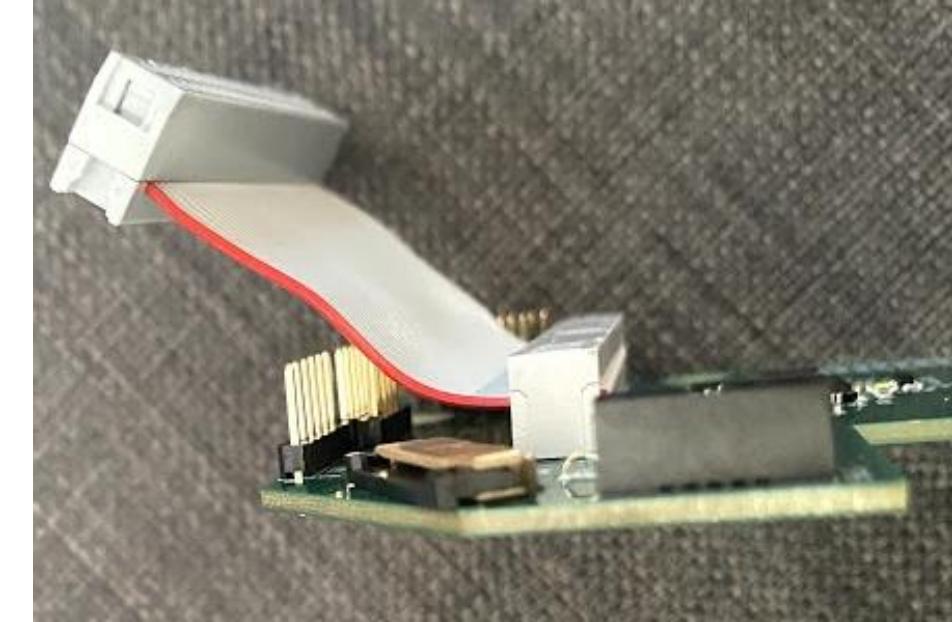
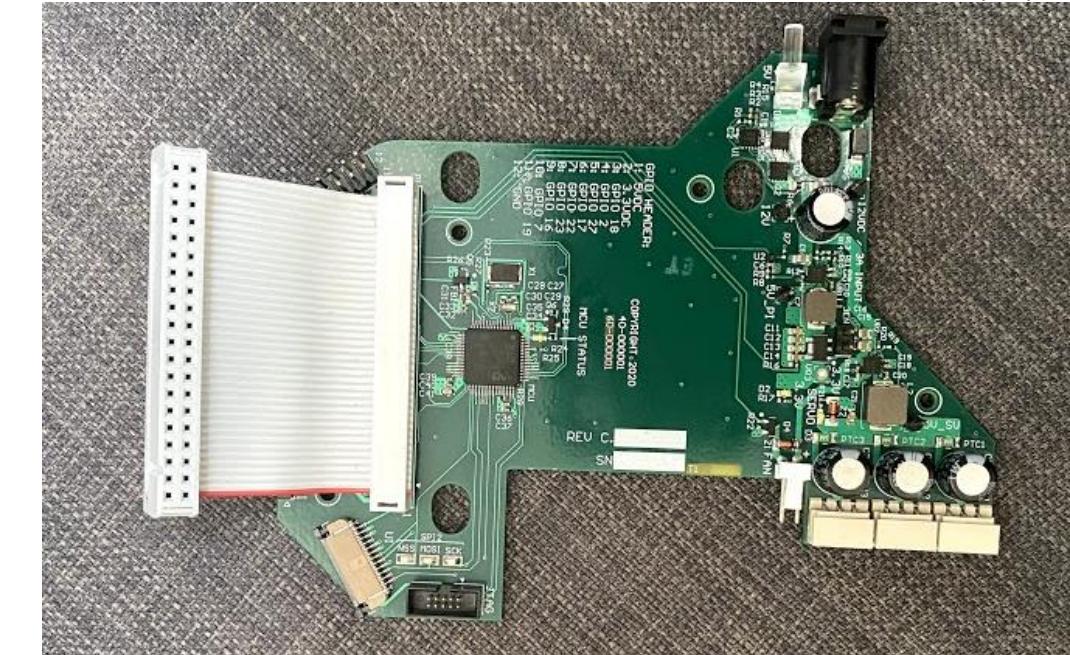
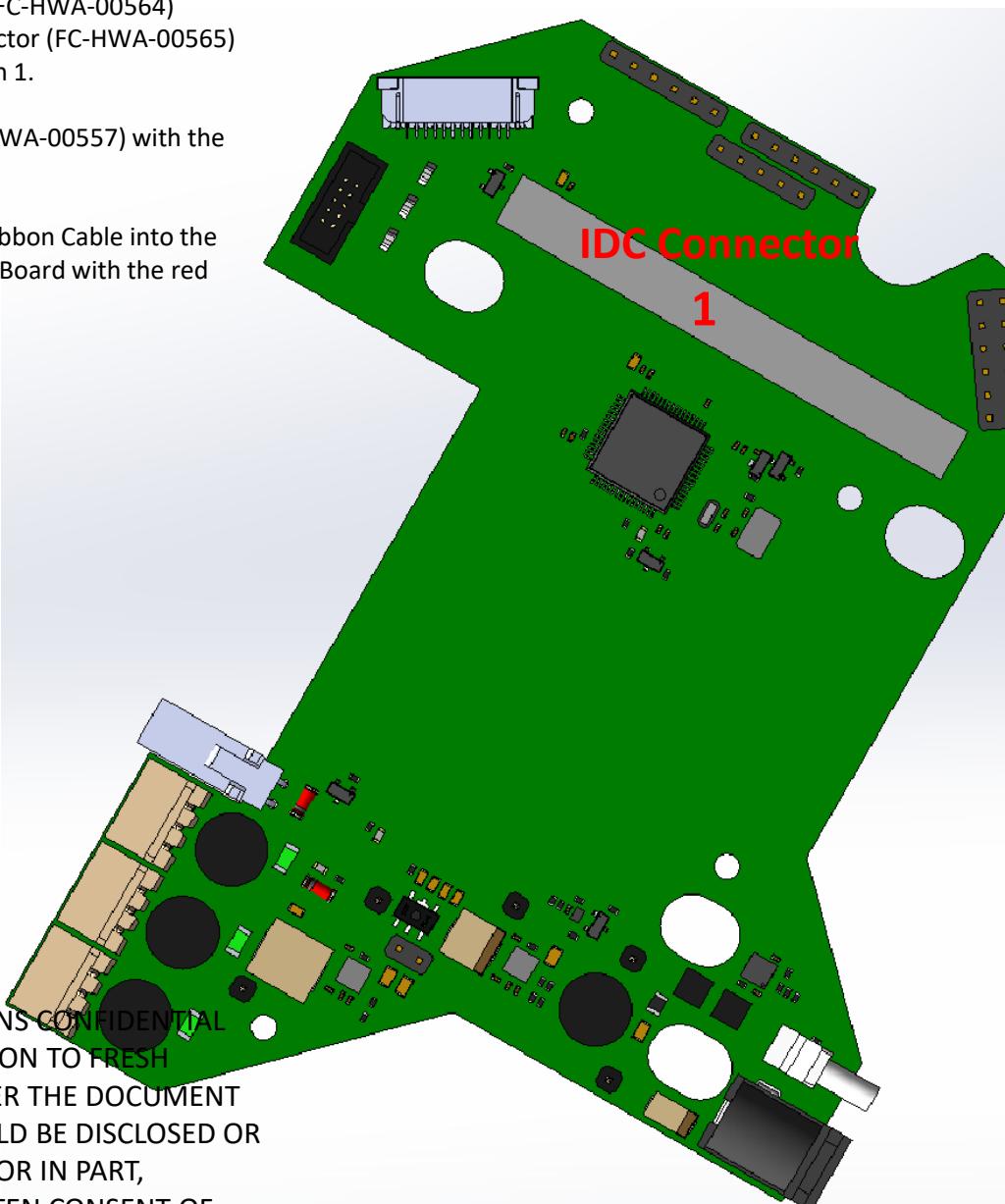


## STEP 1

Cut 40 Wire Ribbon Cable (FC-HWA-00564) to 1.75". Attach IDC connector (FC-HWA-00565) with the red wire in position 1.

Place the Main Board (FC-HWA-00557) with the components facing up.

Slot the other side of the Ribbon Cable into the IDC connector on the Main Board with the red wire in position 1.



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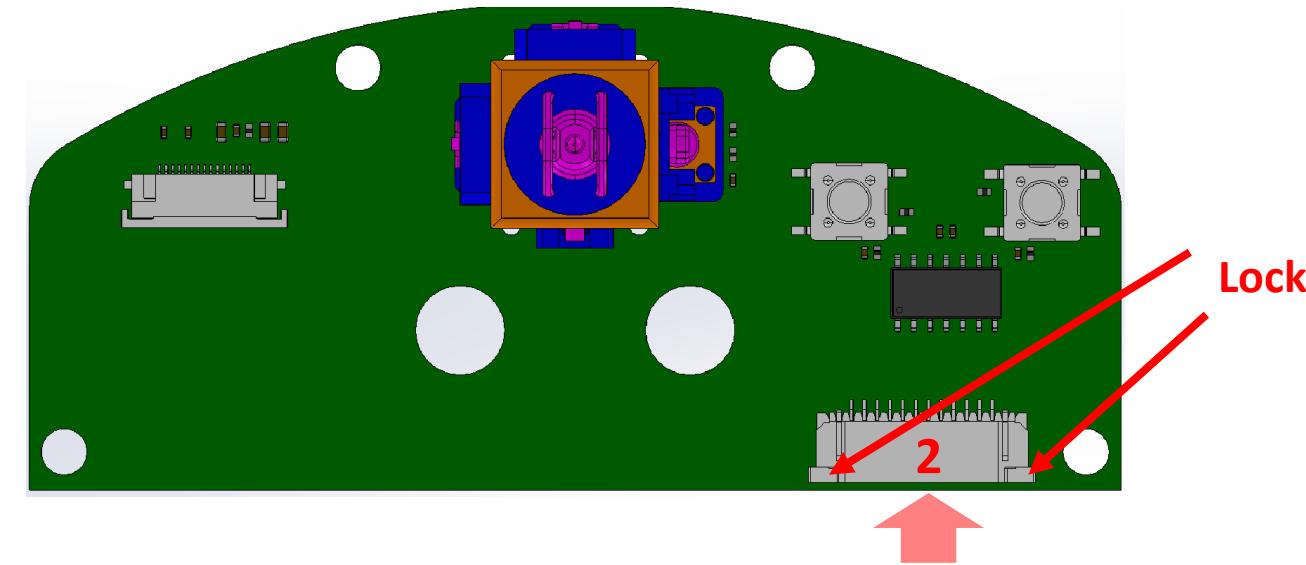




## STEP 3

Place the UI Board (FC-HWA-00574) with the components facing up.

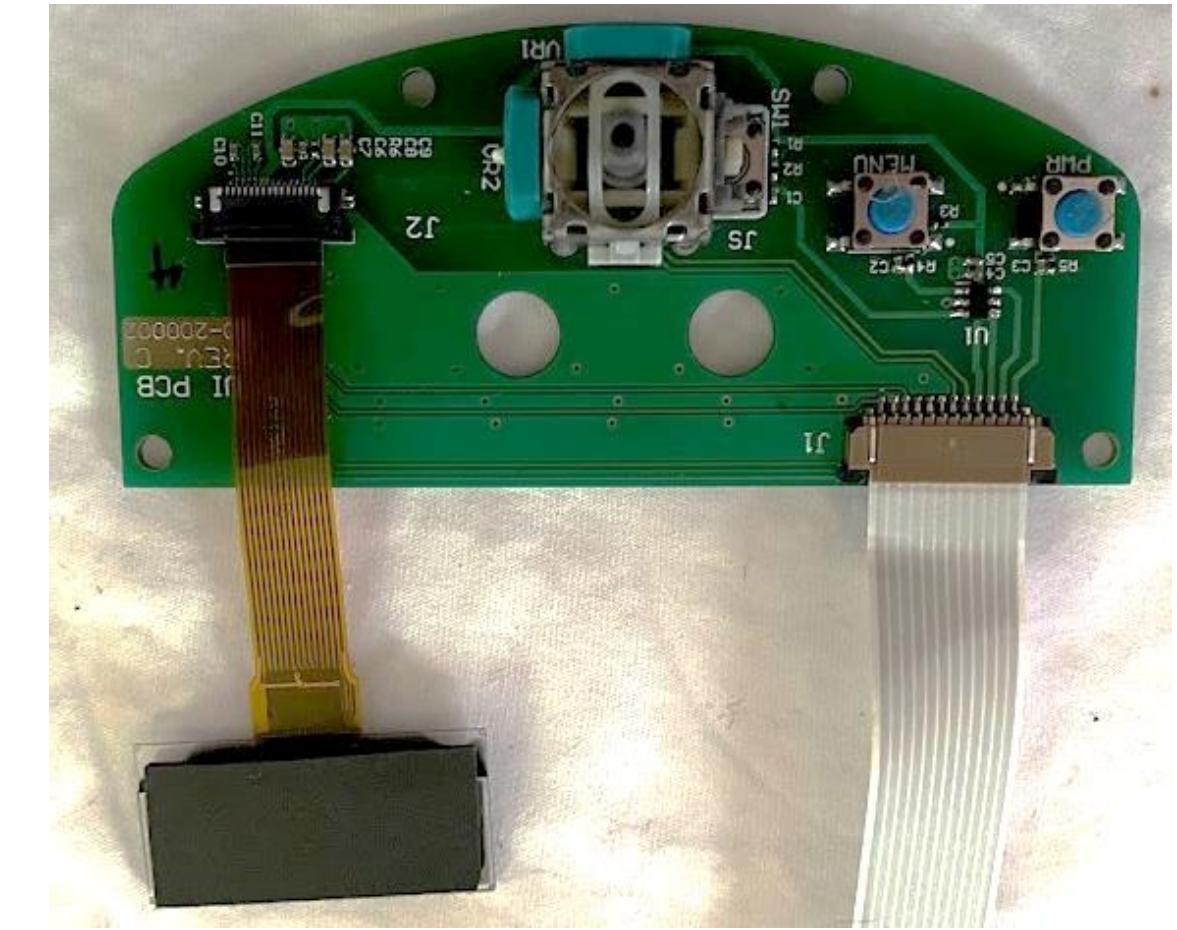
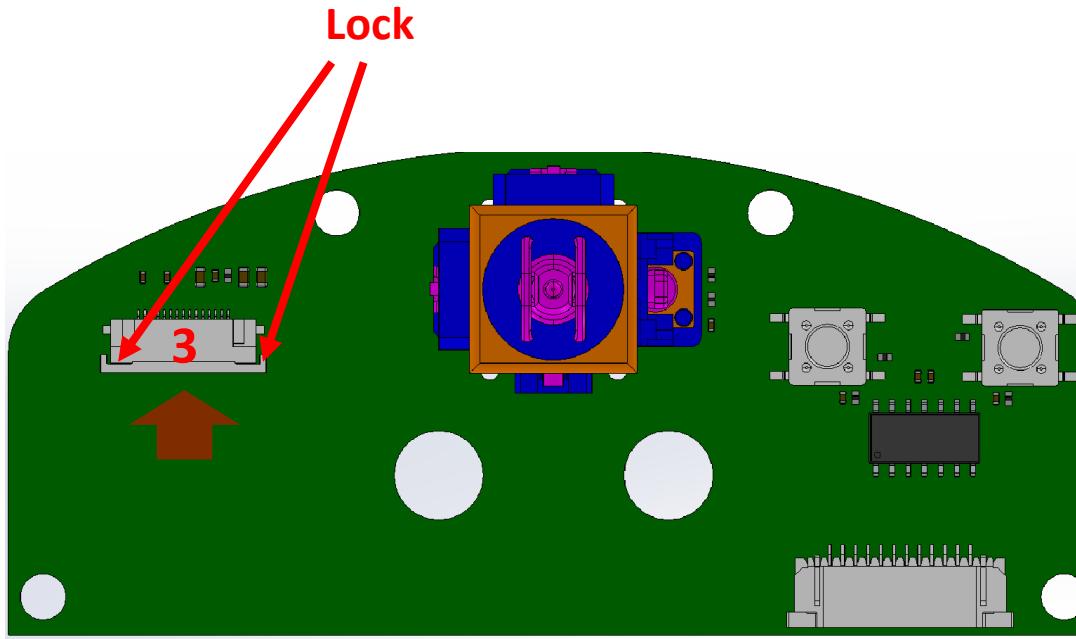
Gently lift plastic lock on indicated port **2** Insert Ribbon Cable and ensure the ribbon cable contacts are contacting the port contacts. Press the plastic lock back into the locked position.



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## STEP 4

Gently lift plastic lock on indicated port **3** Insert the Screen's Ribbon Cable (FC-HWA-00580) and ensure the ribbon cable contacts are contacting the port contacts. Press the plastic lock back into the locked position.

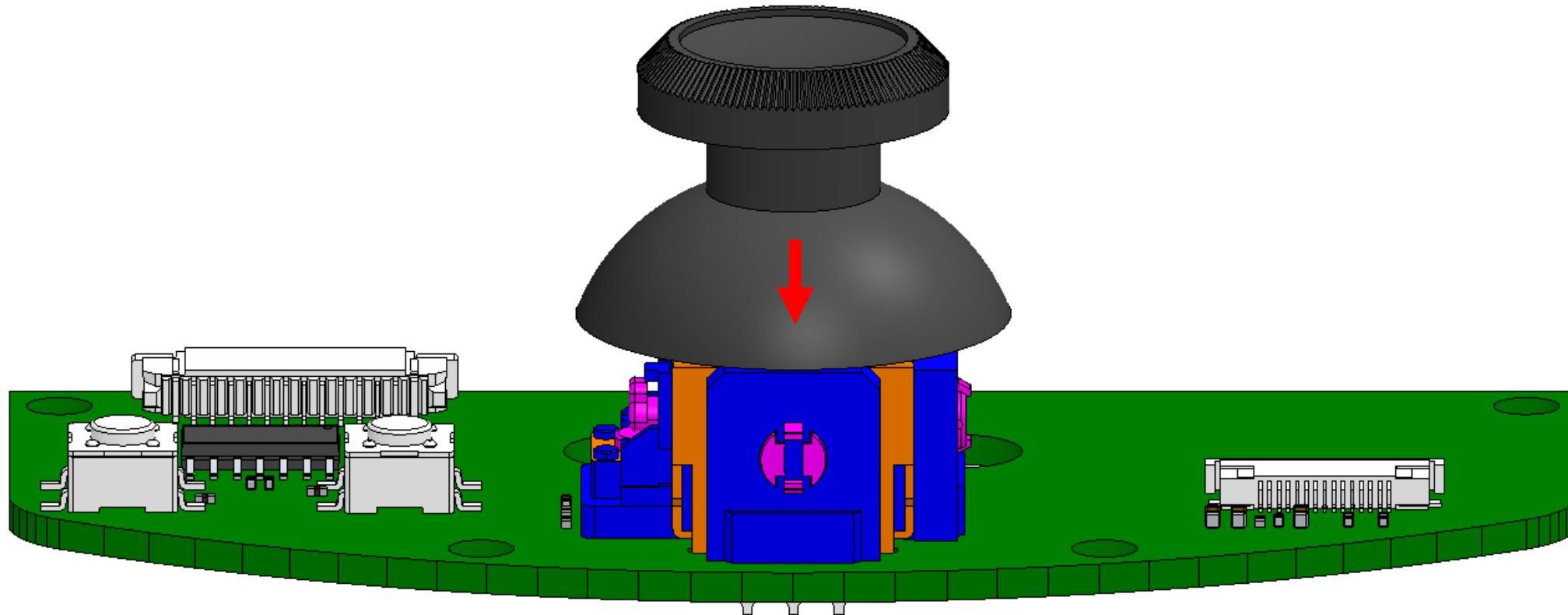


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## STEP 5

Place Thumbstick (FC-HWA-00575) on ALPS Joystick module on the UI Board (FC-HWA-00574). The UI Board should still be attached to the Main Board from the Board Test



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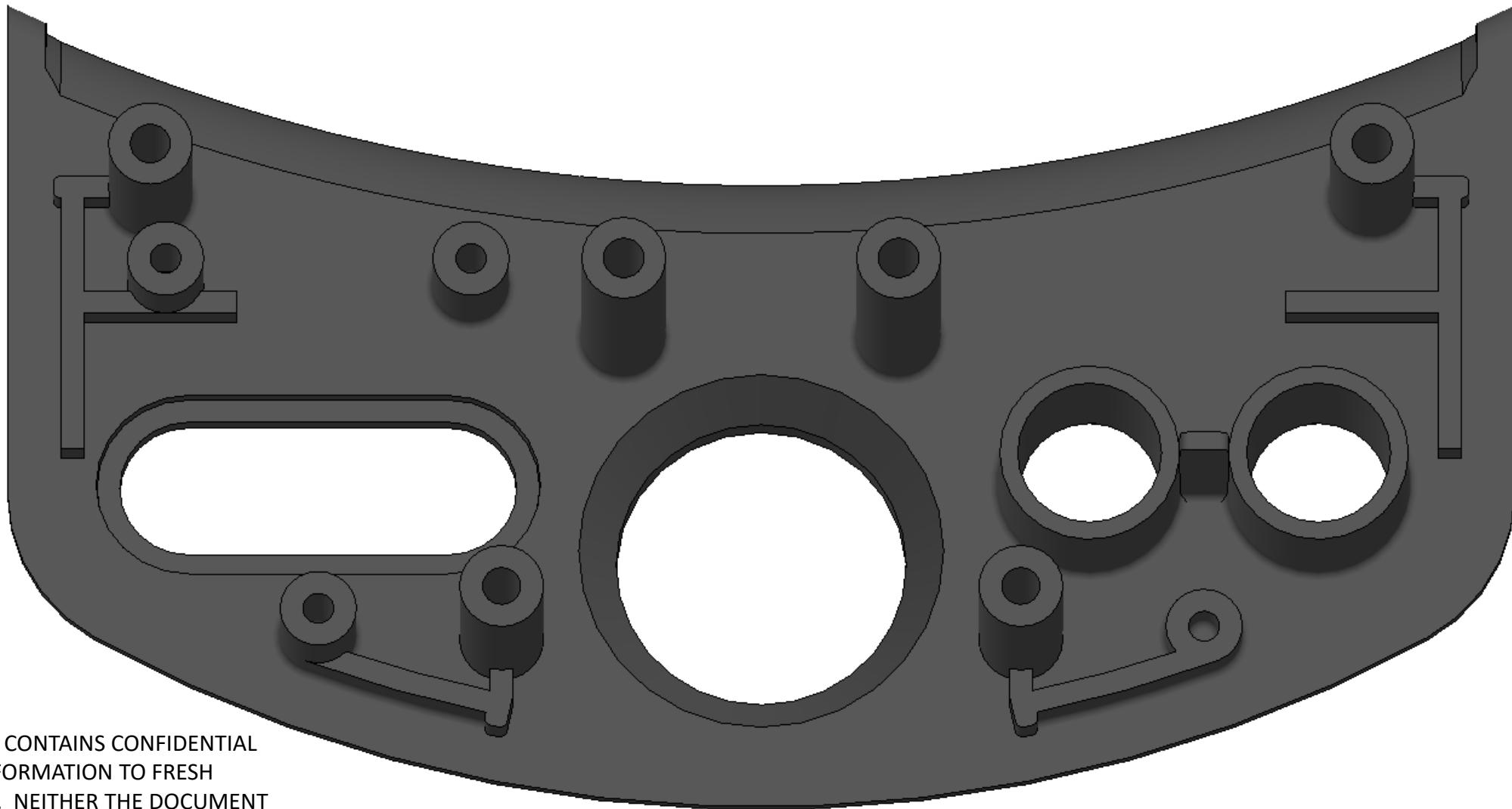
# Control Panel Assembly

(aka. UI Sub-Assembly)



## STEP 1

Flip Control Panel (FC-HWA-00573) so bottom is facing up.



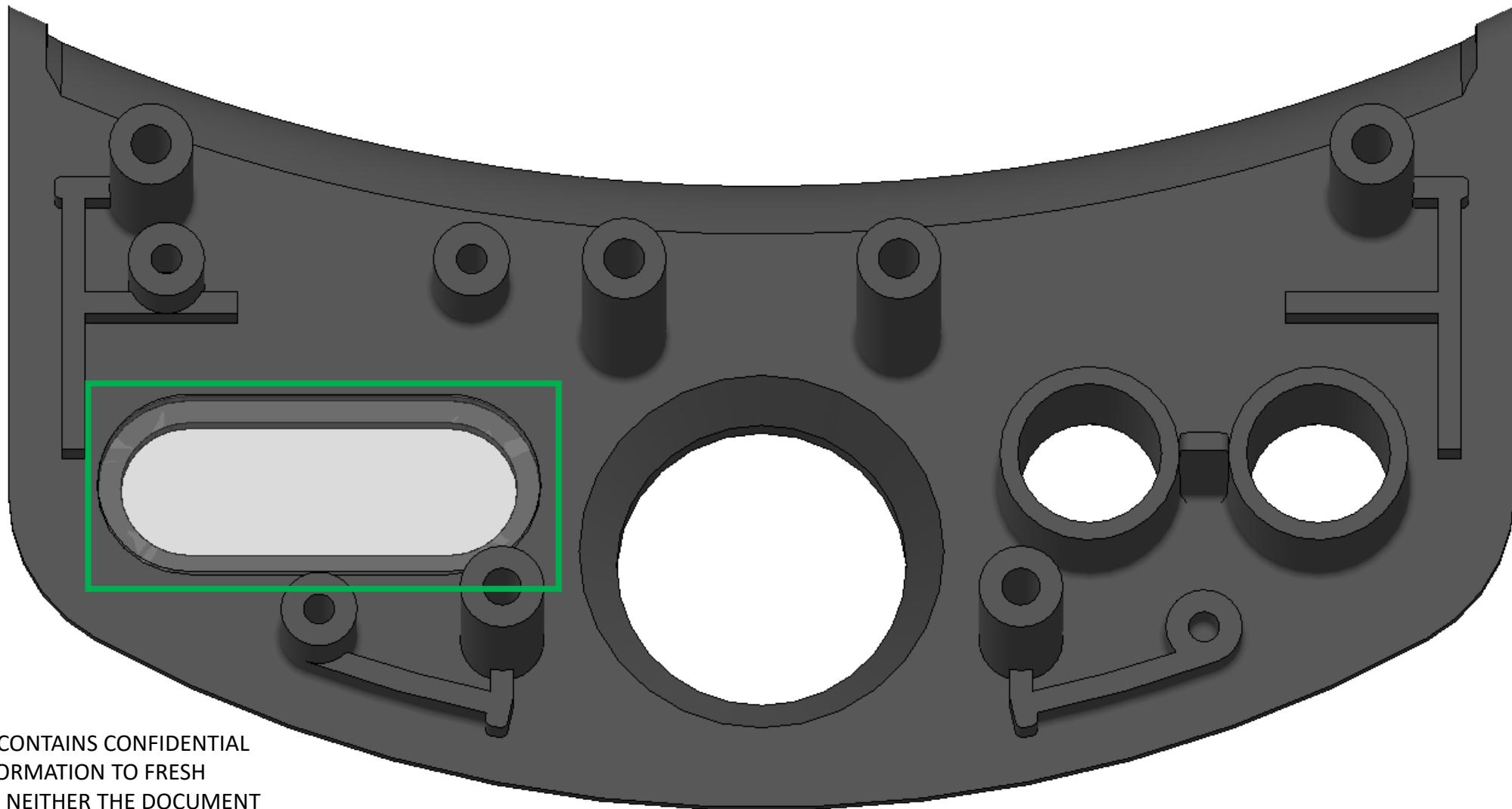
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## STEP 2

Insert Screen Cover (FC-HWA-00579) into pocket  
in Control Panel.



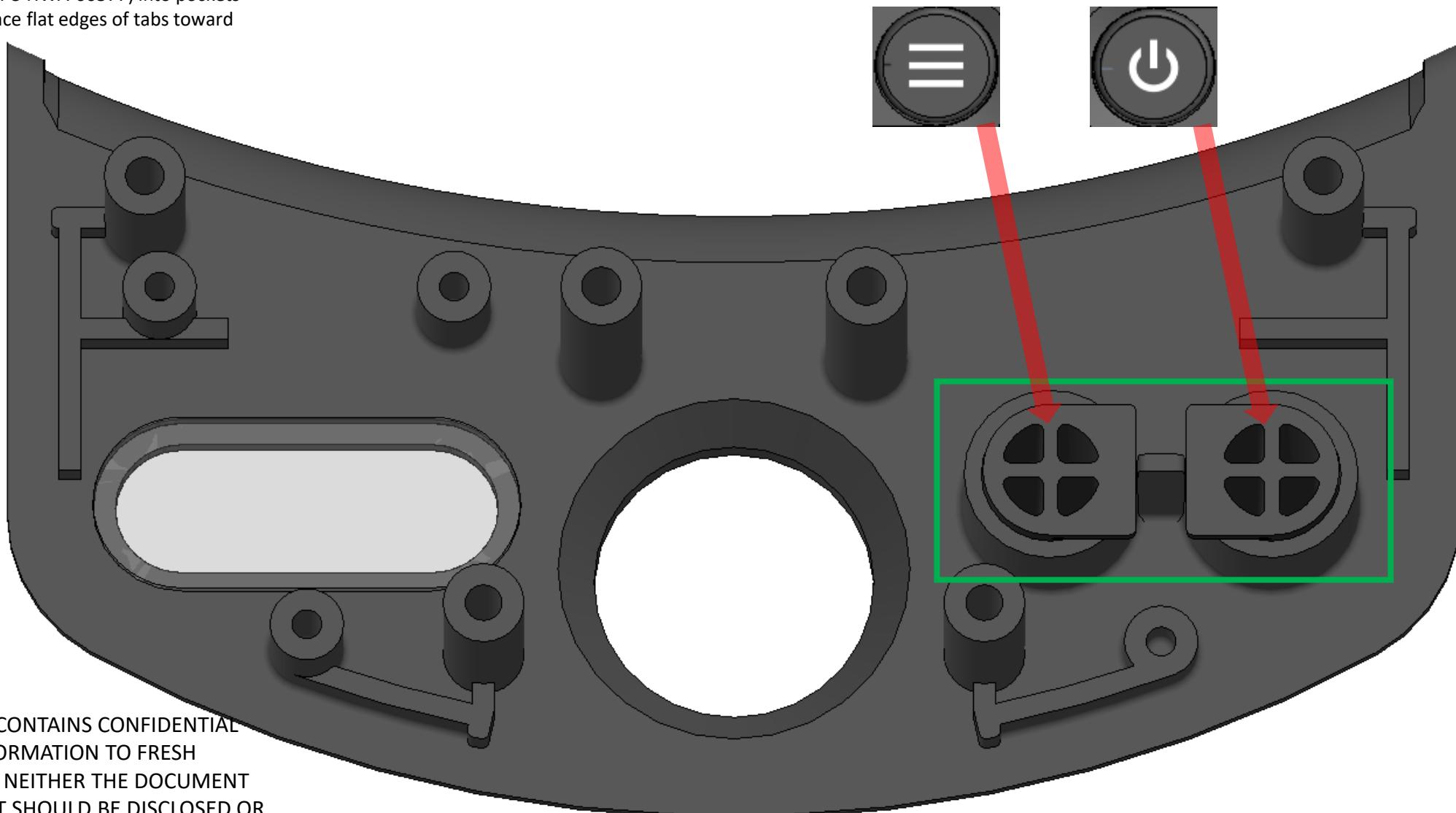
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### STEP 3

Insert Power Button Cap (FC-HWA-00576) and Menu Button Cap (FC-HWA-00577) into pockets in Control Panel. Face flat edges of tabs toward each other.



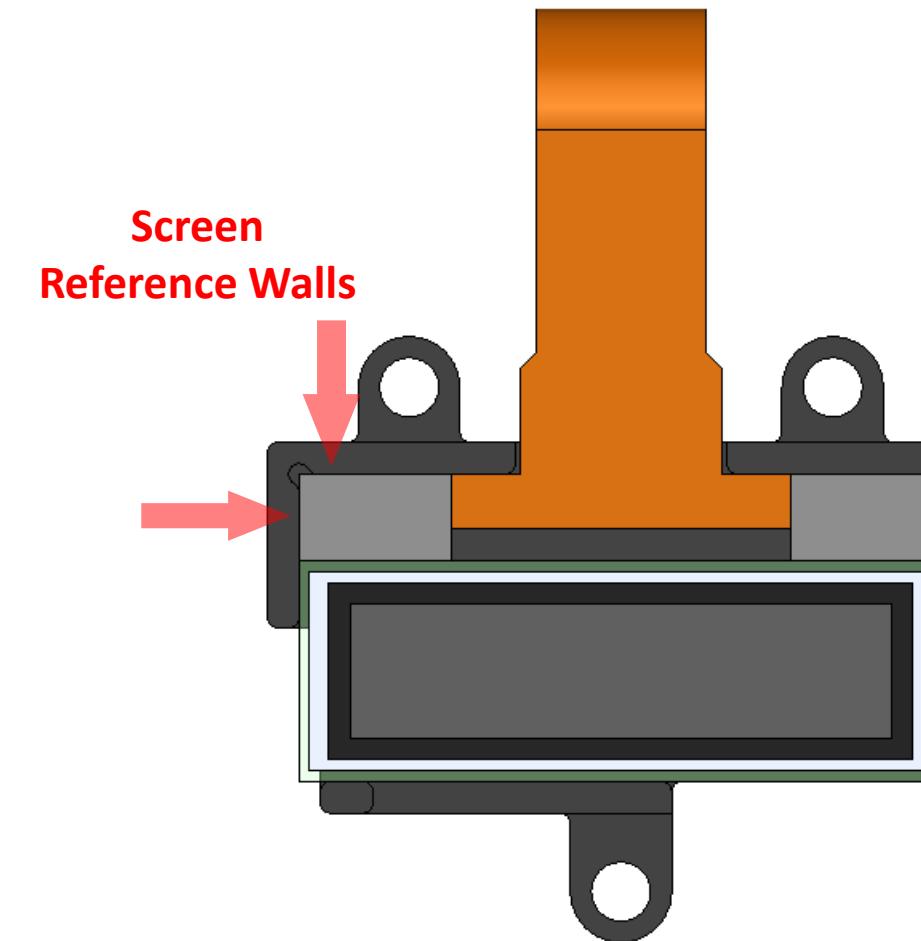
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## STEP 4

Cut adhesive backed foam (FC-HWA-00740) to 28mm long and center on the back of the screen

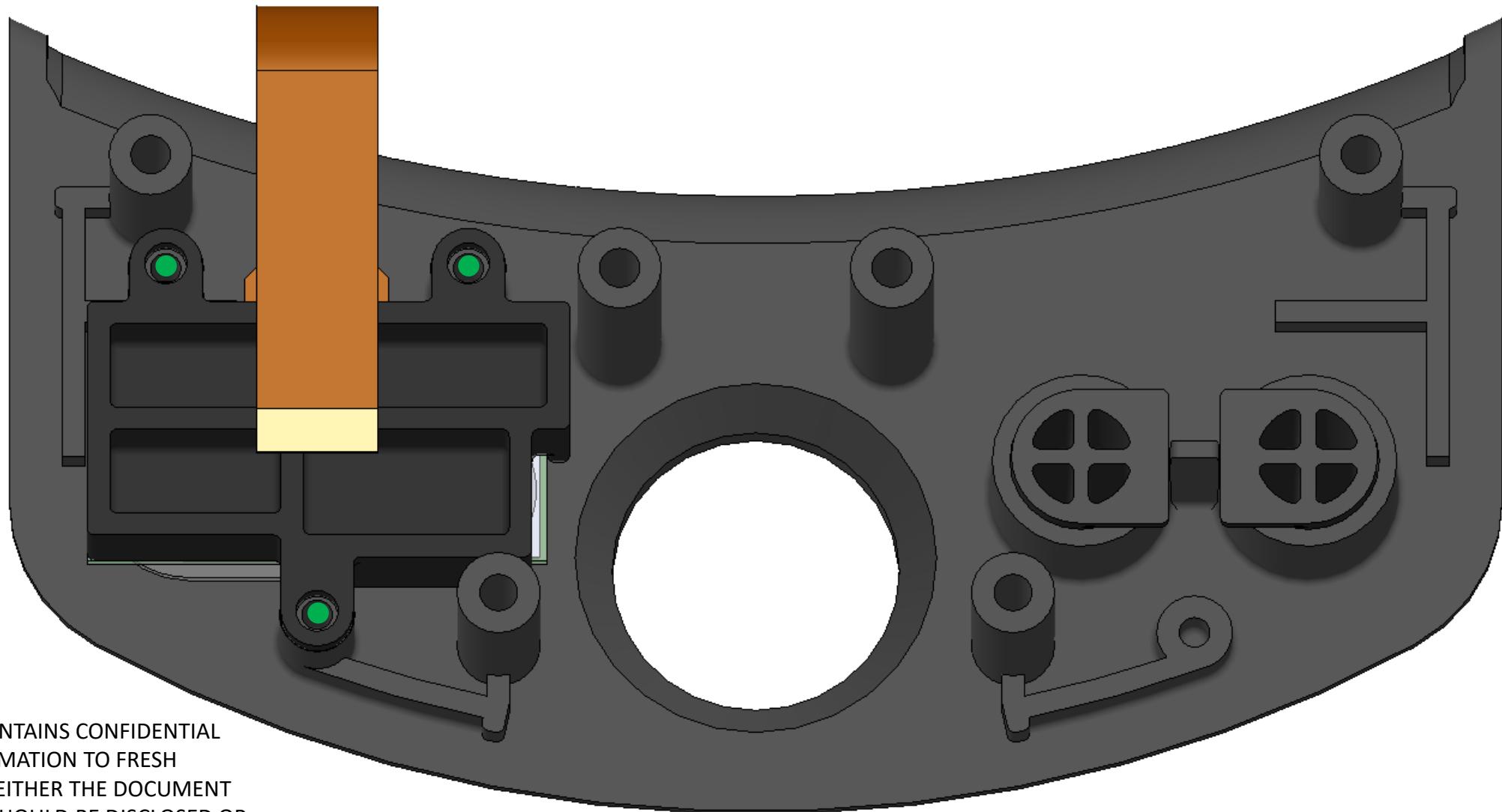
Very carefully place Screen (FC-HWA-00580) into Screen Carrier (FC-HWA-00578). Reference screen against the two indicated walls.



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## STEP 5

Place Screen Carrier on Control Panel and align holes.



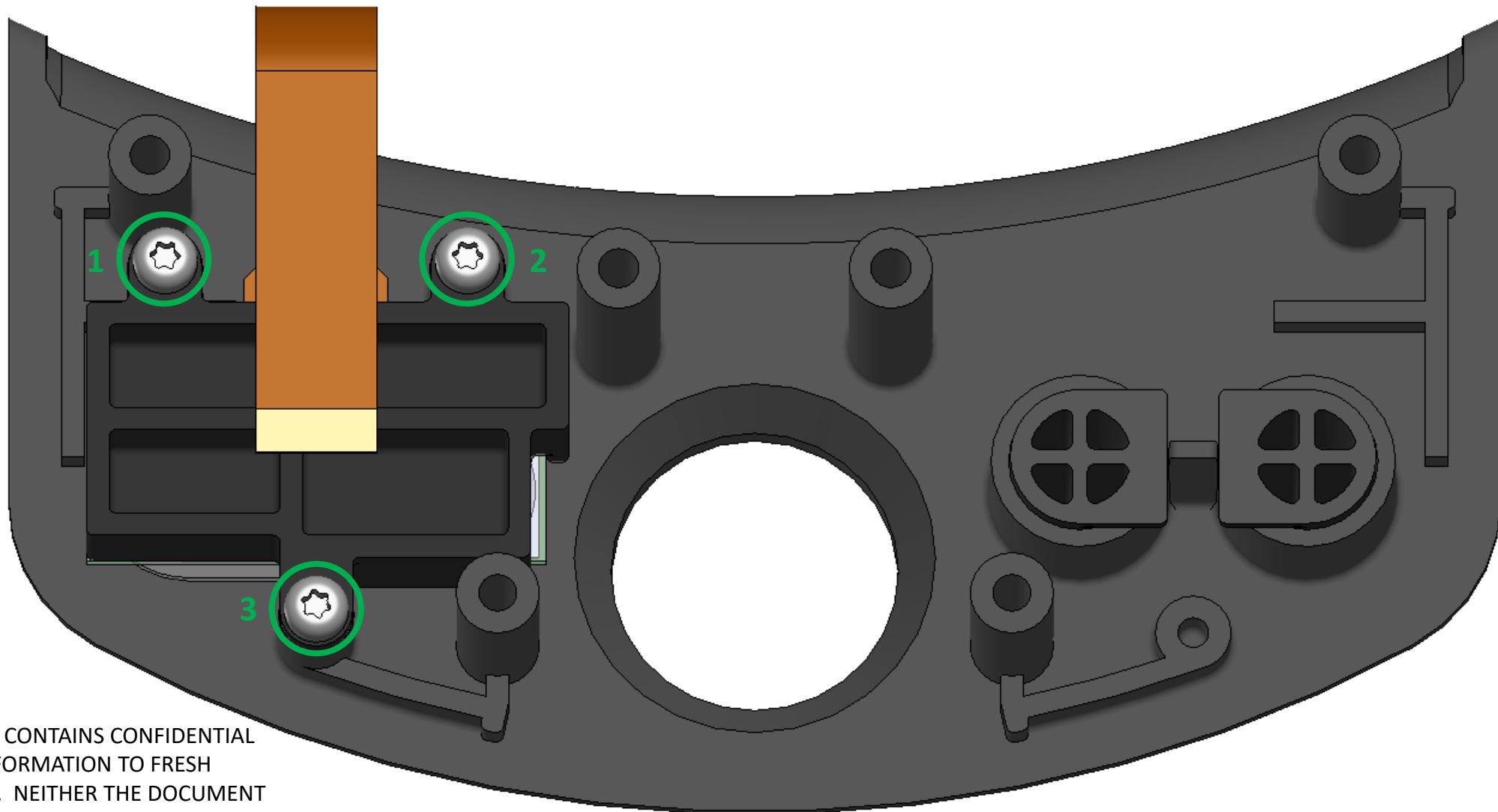
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## STEP 6

Fasten Screen Carrier to Control Panel with QTY 3 M2.5 x 8mm Plastite screws (FC-HWA-00594). Tighten to 4 in-lb.



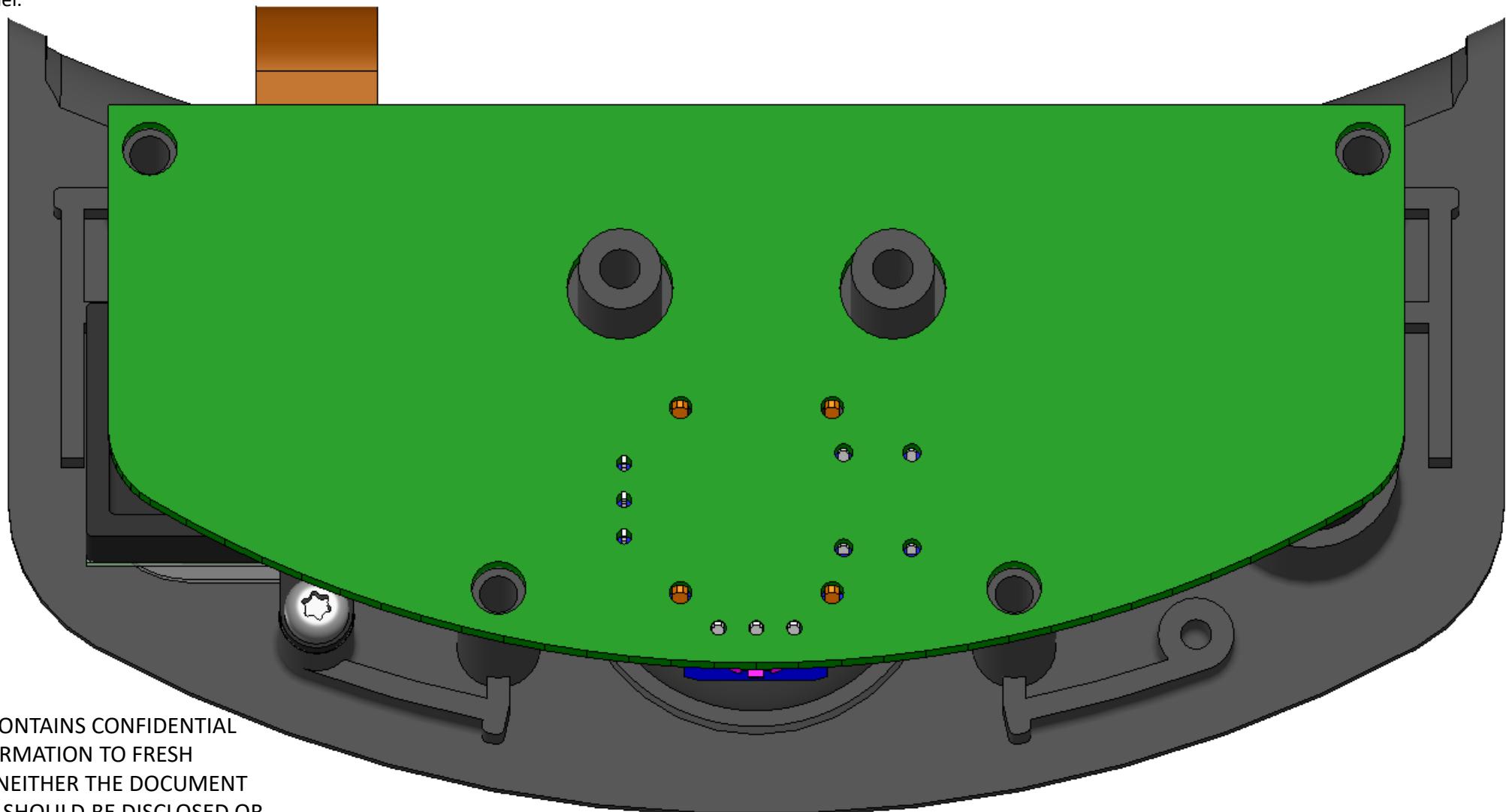
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## STEP 8

Place UI board on Control Panel with standoffs protruding through board and thumbstick through Control Panel.



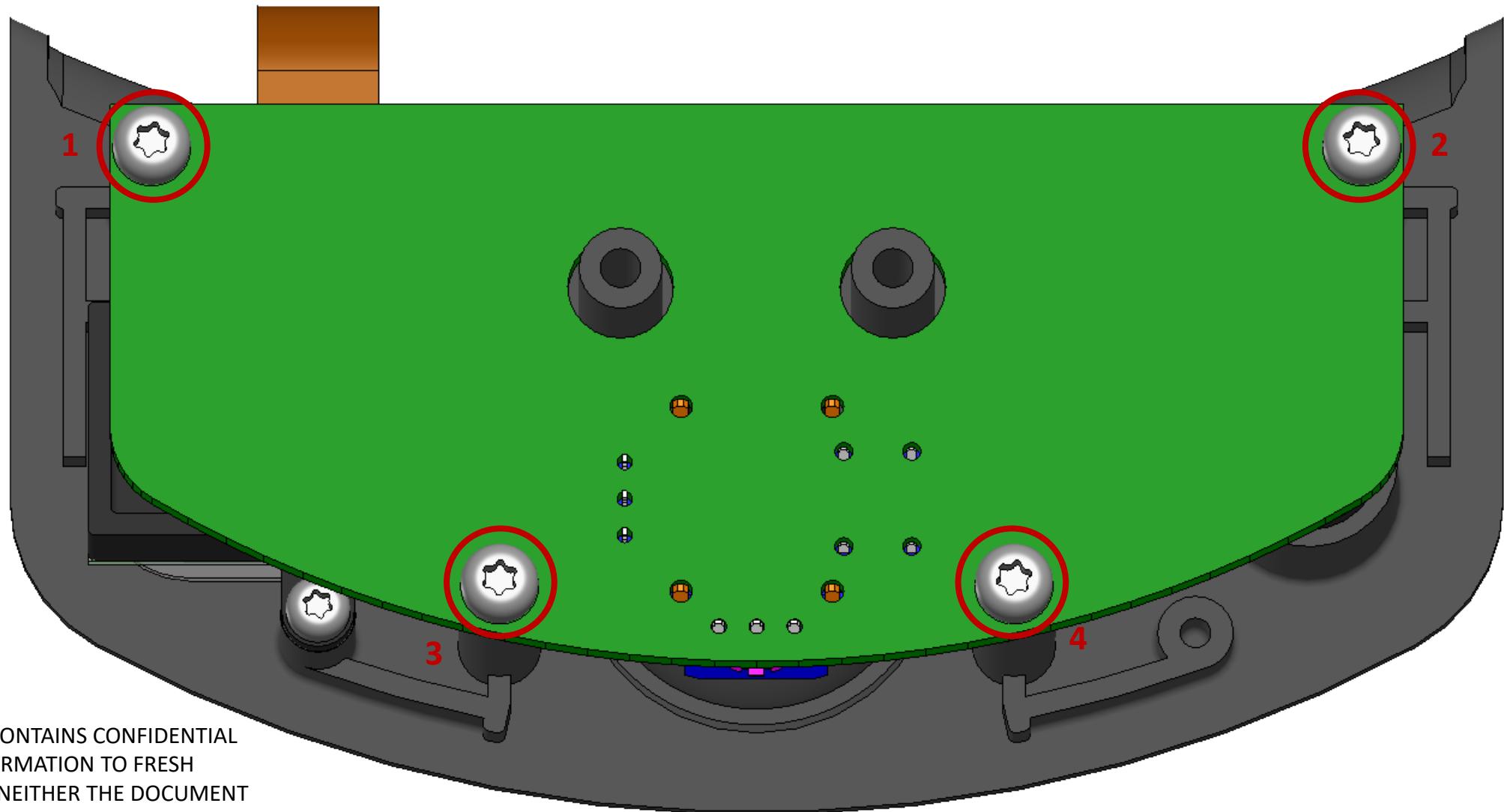
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## STEP 9

Fasten UI board to Control Panel using QTY 4 M2.5 x 8mm Plastite screws (FC-HWA-00594). Tighten to 4 in-lb. Ensure  &  buttons click properly.



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Conduct Board Test with instructions on Page 3 of the Moab Test Procedure Document (03252-DOC-INS02)

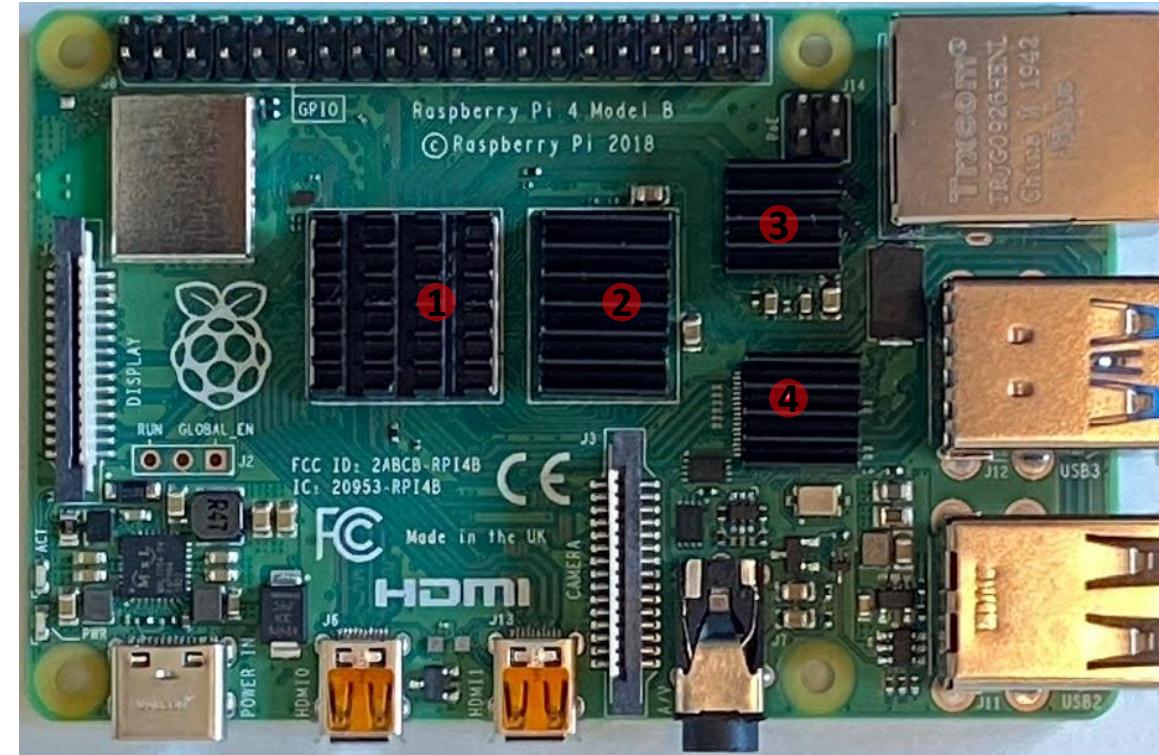


# Raspberry Pi Sub Assembly



## STEP 1

Add Heat Sinks (FC-HWA-00561) to the indicated 4 locations on the Raspberry Pi.



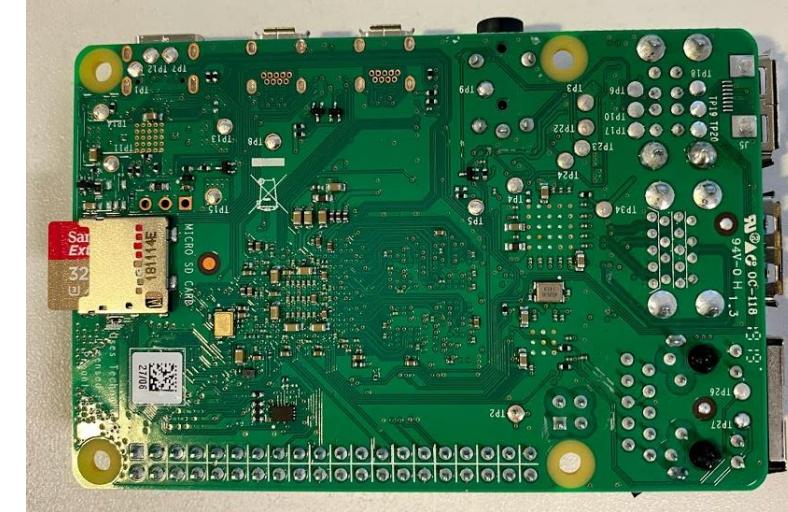
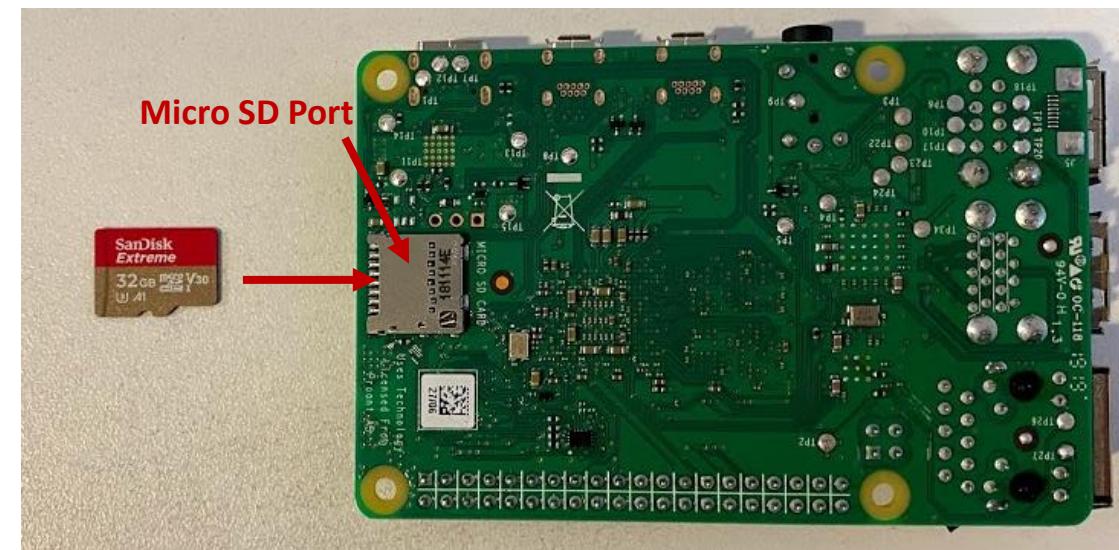
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## STEP 2

Insert Micro SD Card (FC-HWA-00563) into the indicated Micro SD Port on the Raspberry Pi using the shown SD card orientation.



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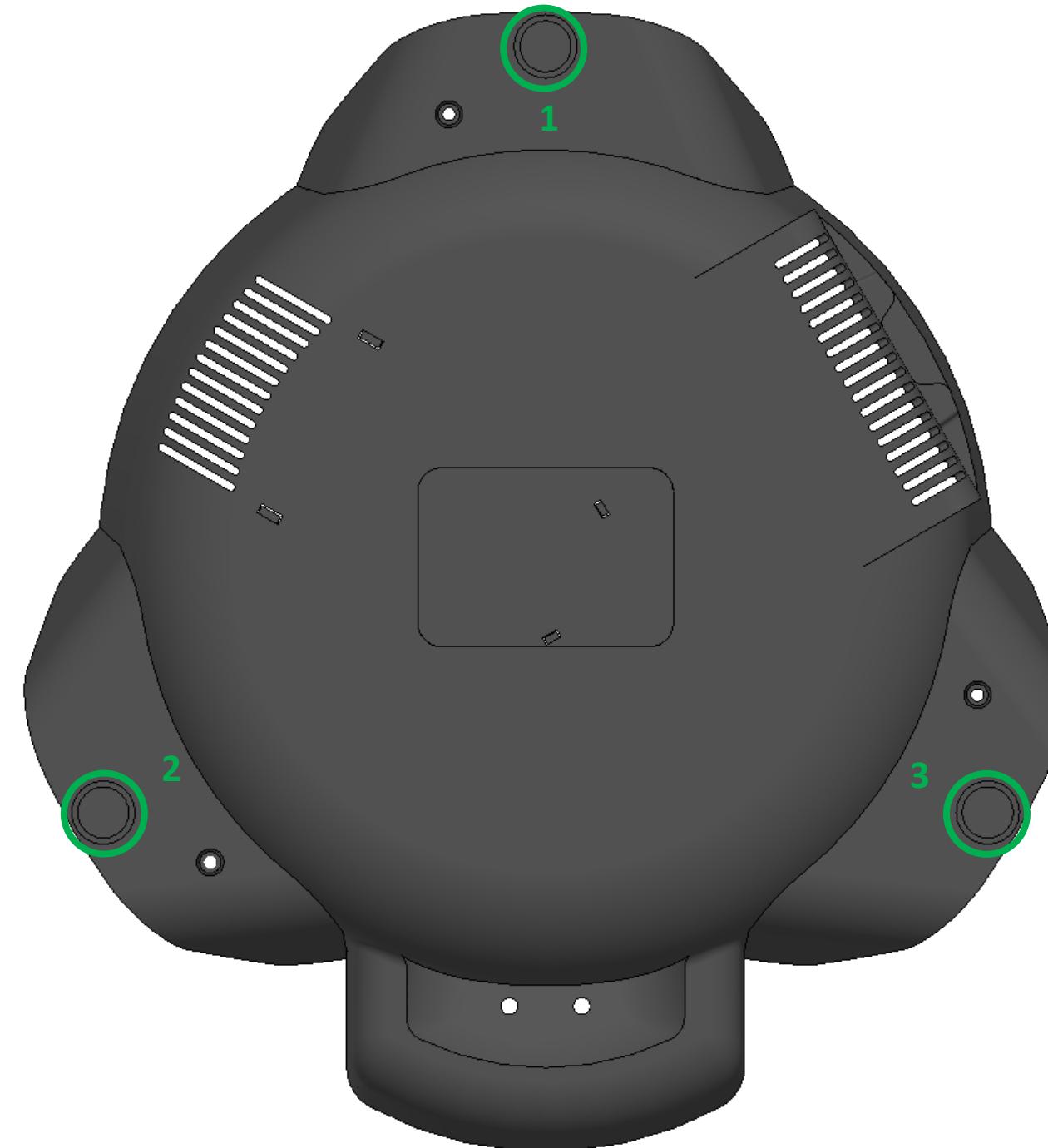
# Bottom Assembly



## STEP 1

Place Bottom Housing (FC-HWA-00555) with the flat side is facing up.

Clean foot mounting locations with isopropyl alcohol.

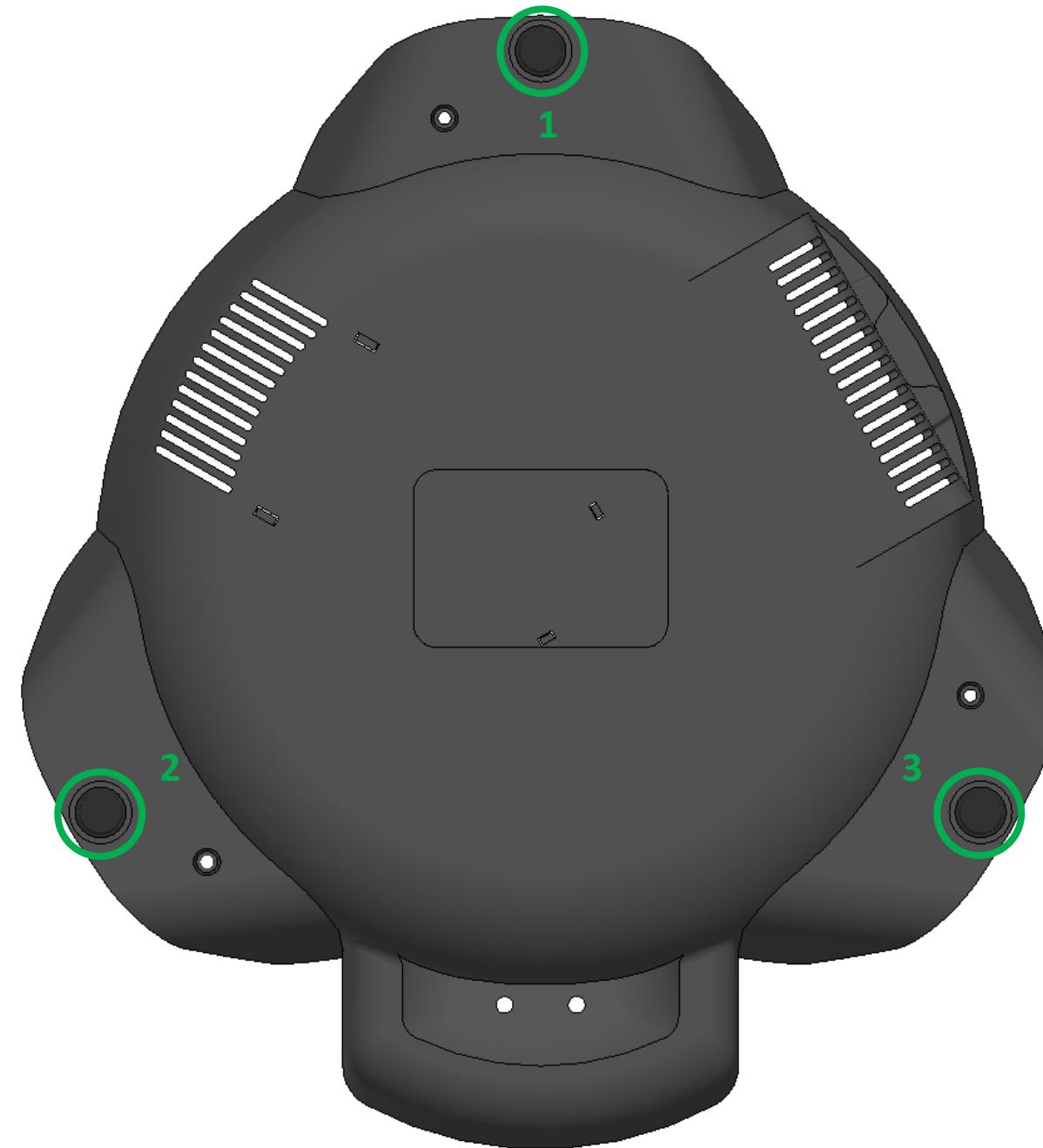


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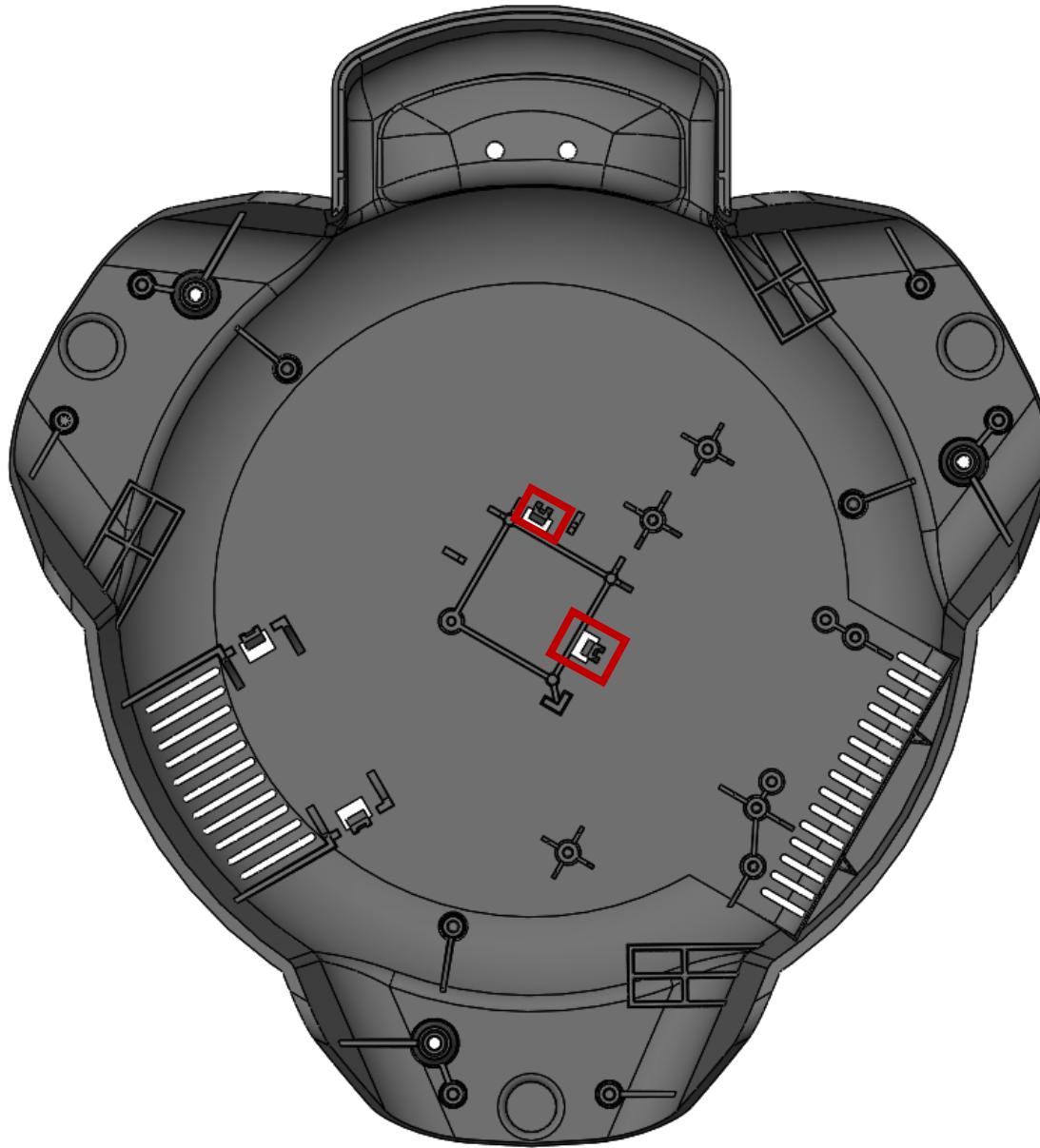
## STEP 2

Apply QTY 3 adhesive backed rubber feet (FC-HWA-00558) into the pockets on the underside of the bot.

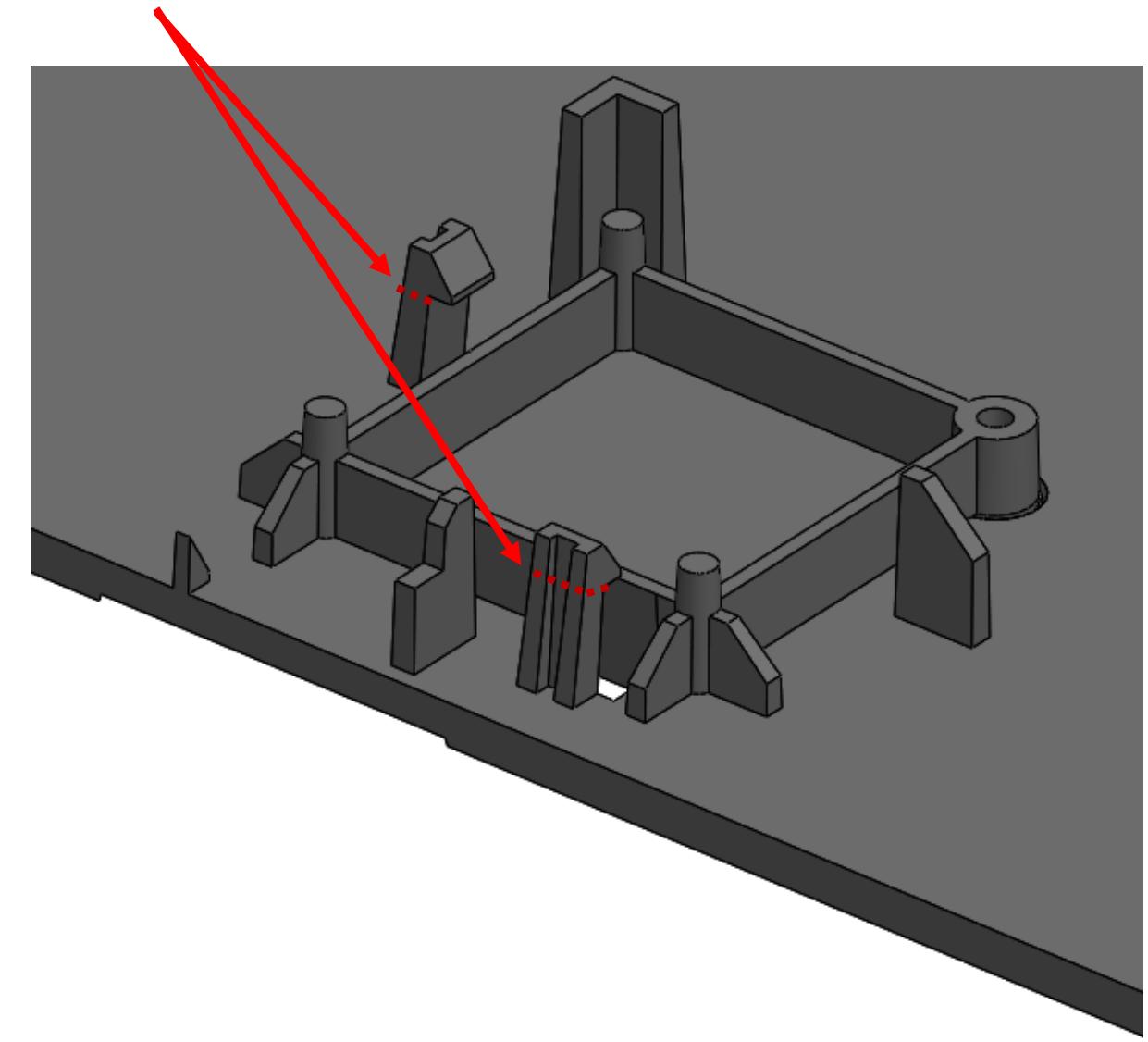


### STEP 3

Flip Bottom Housing to the concave side. Cut off the 2 snaps (labeled with red boxes below) below the overhang.

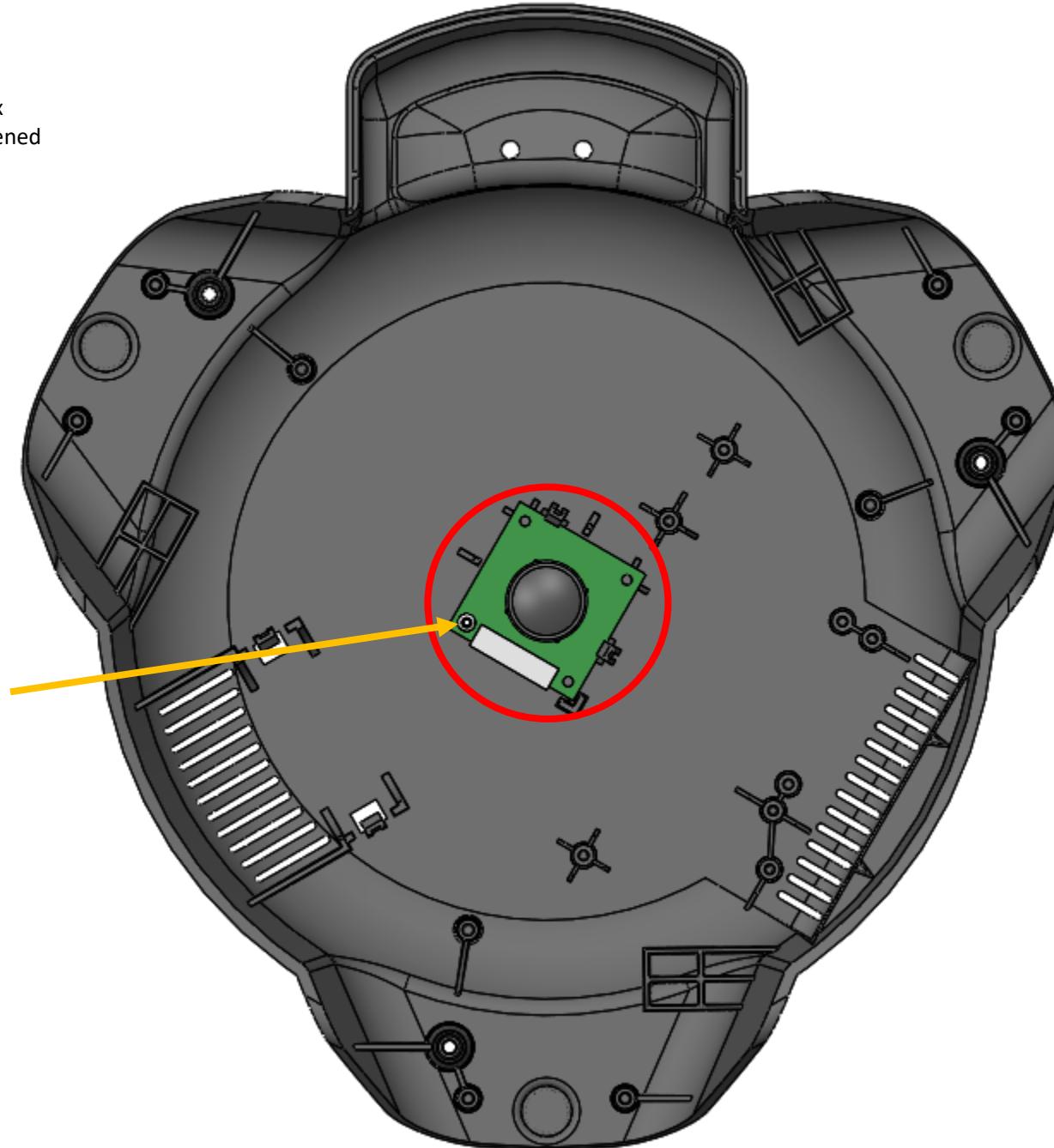


Cut Lines



## STEP 4

Place camera (FC-ASM-00287) on the 4 posts with connector facing the 7 o'clock position. Use a M2.5 x 8mm (FC-HWA-00594) to fasten the camera . (Tightened to 4 in-lb)



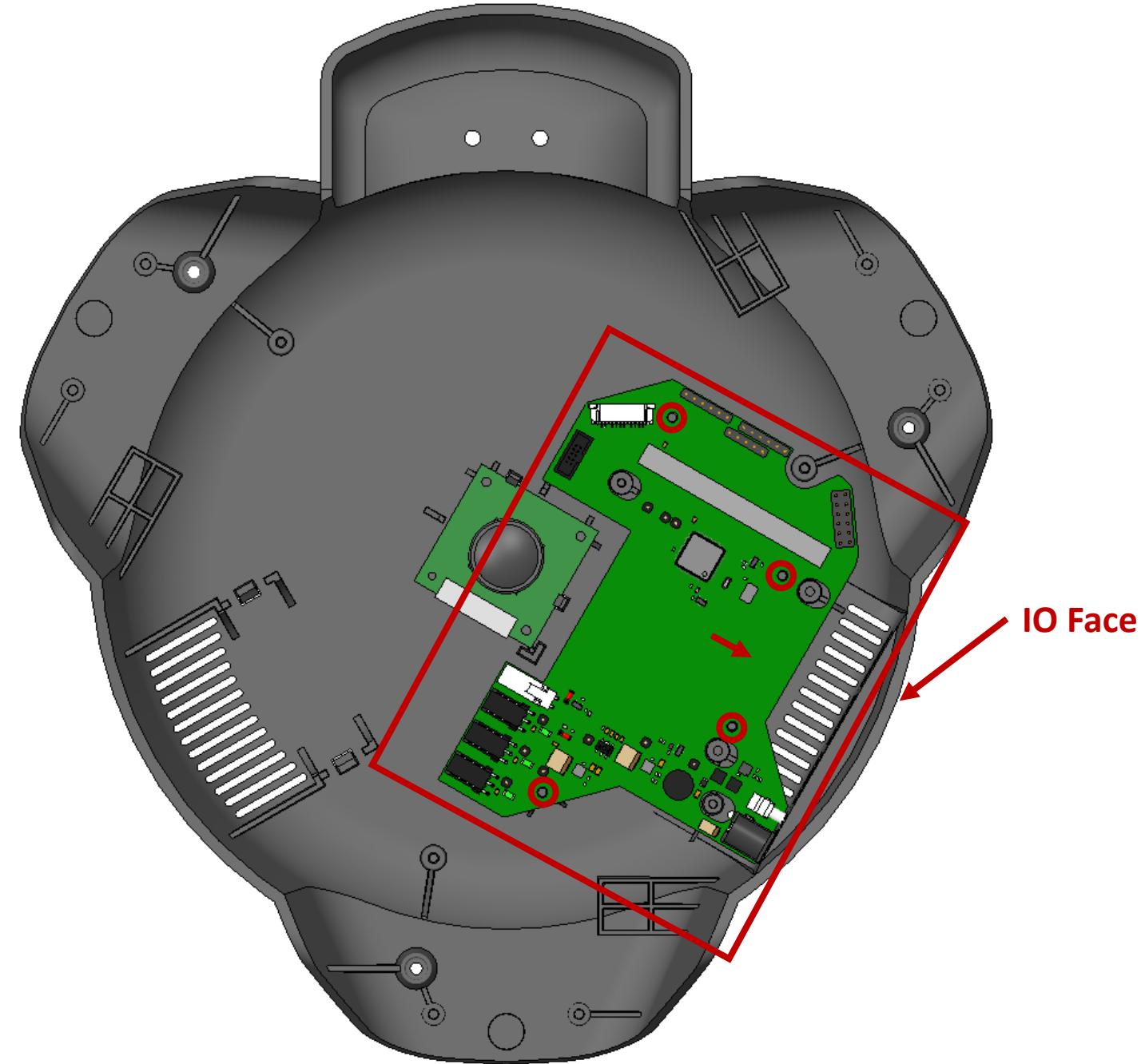
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## STEP 5

Lower Main Board into position. Slide board toward IO face until the lower holes are visible.



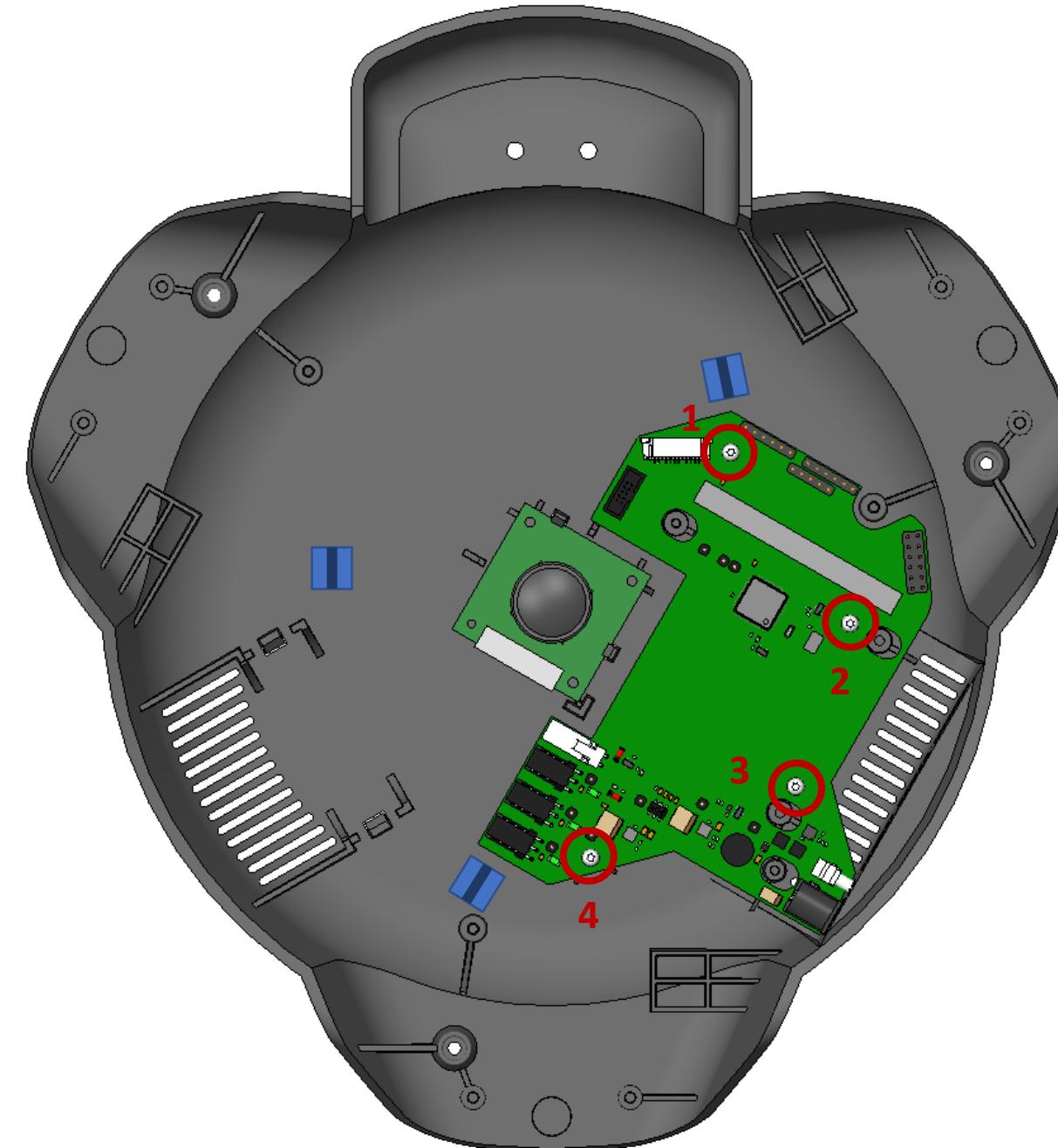
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## STEP 6

Fasten Main Board down with QTY 4 M2.5 x 8mm Plastite screws (FC-HWA-00594). Tighten to 4 in-lb.

Place adhesive based cable clips (FC-HWA-00746) for the servo wires in the indicated blue square. The cable will run perpendicular to the dark blue line.



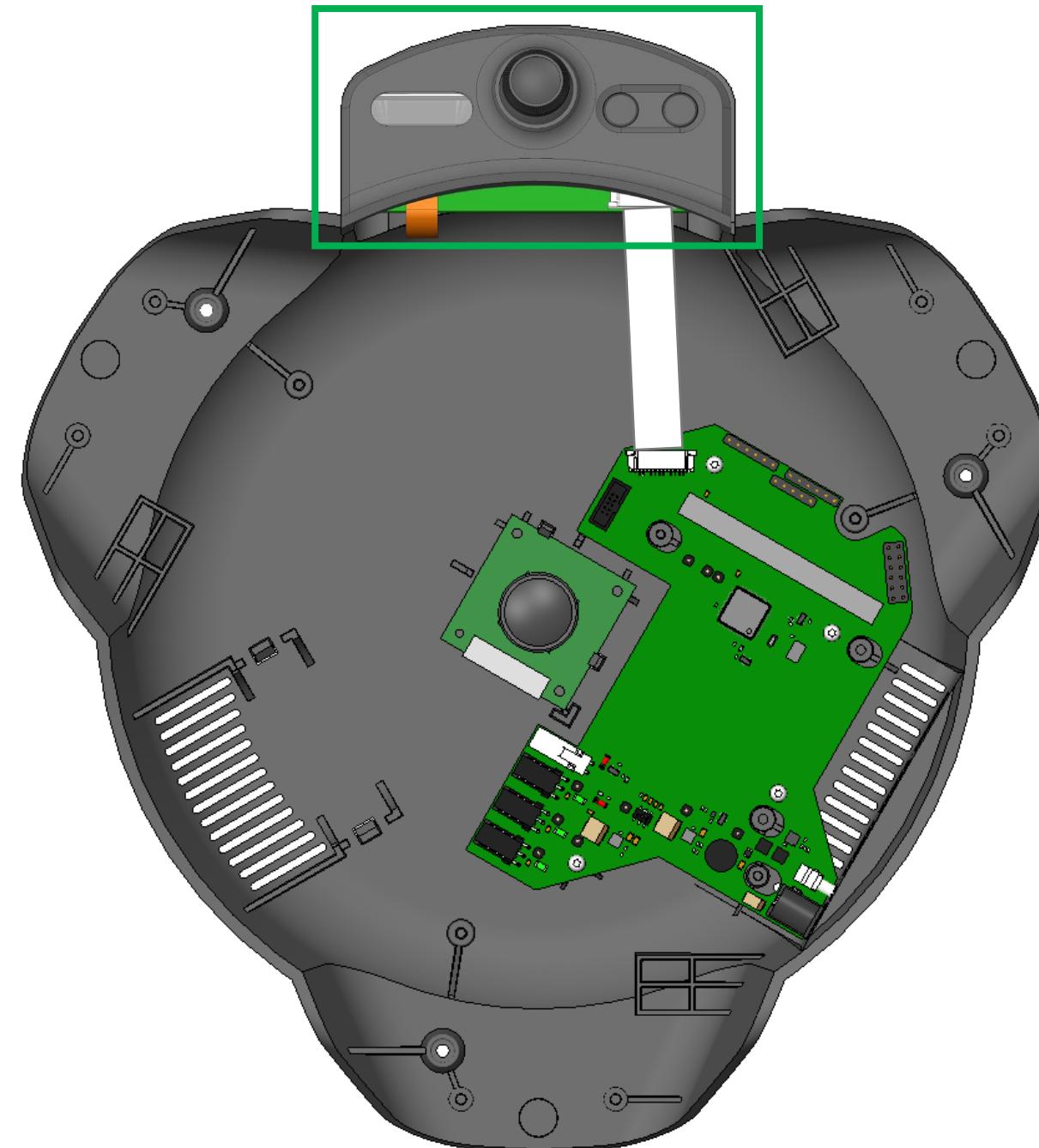
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## STEP 7

Place Controls Subassembly on Bottom Shell



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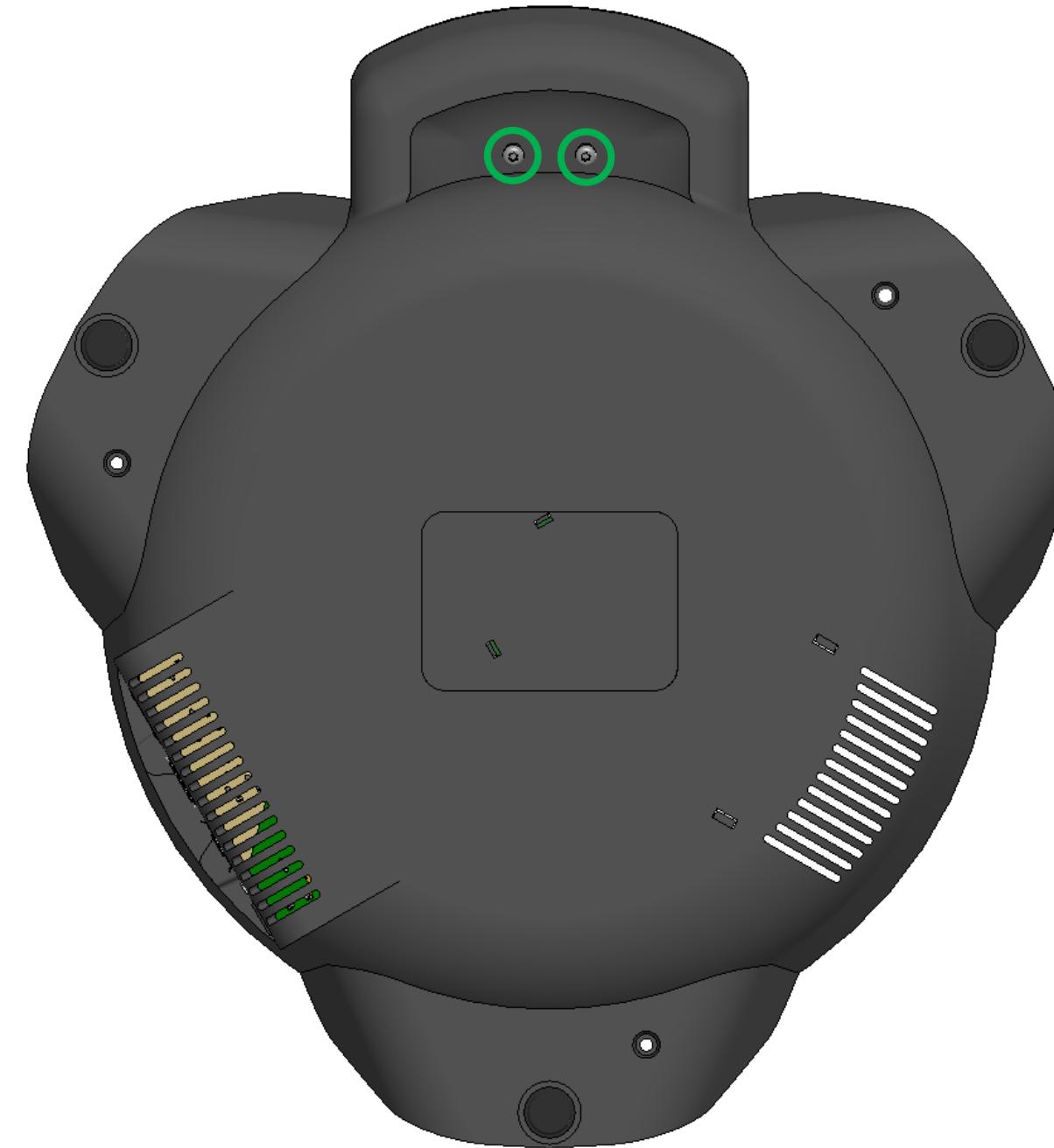


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## STEP 8

While holding Controls Subassembly in place, fasten with QTY 2 Black M2.5 x 10mm Plastite screws (FC-HWA-00761). Tighten to 4 in-lb.

Ensure buttons still click properly.



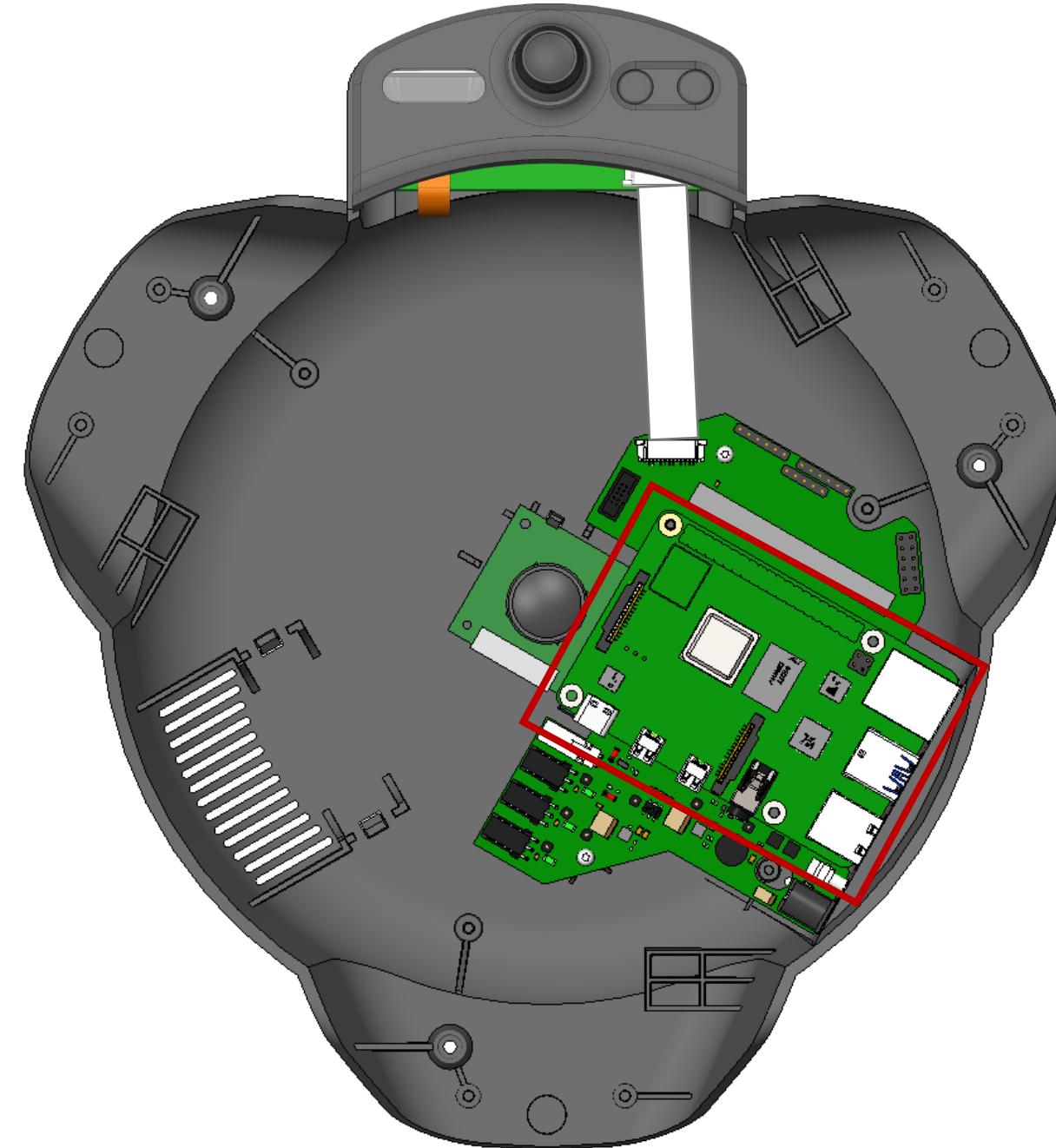
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## STEP 9

Place Raspberry Pi 4B (FC-HWA-00560) on top of holes protruding through the main board.



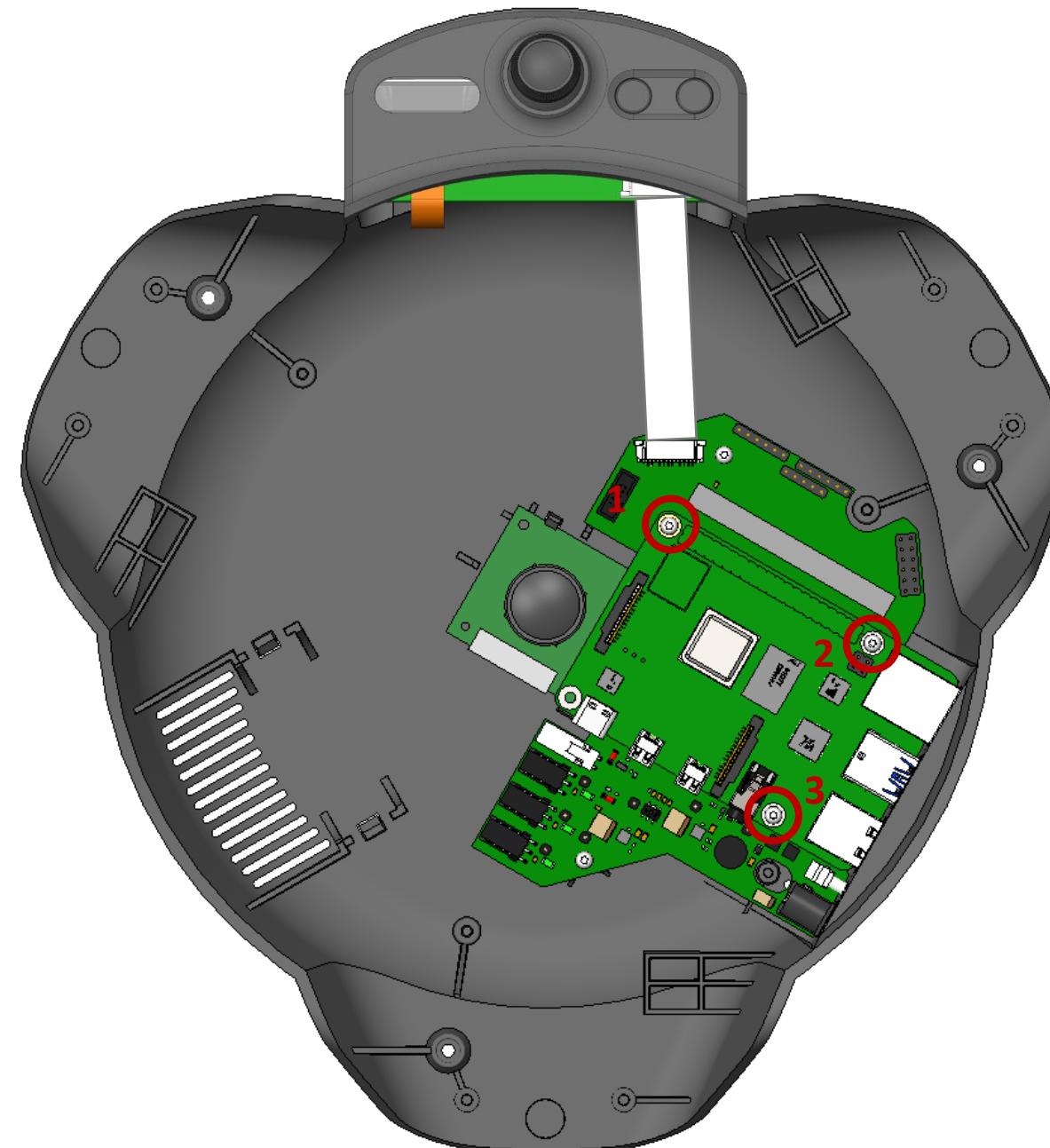
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## STEP 10

Fasten Main Board down with QTY 3 M2.5 x 8mm  
Plastite screws (FC-HWA-00594). Tighten to 4 in-lb

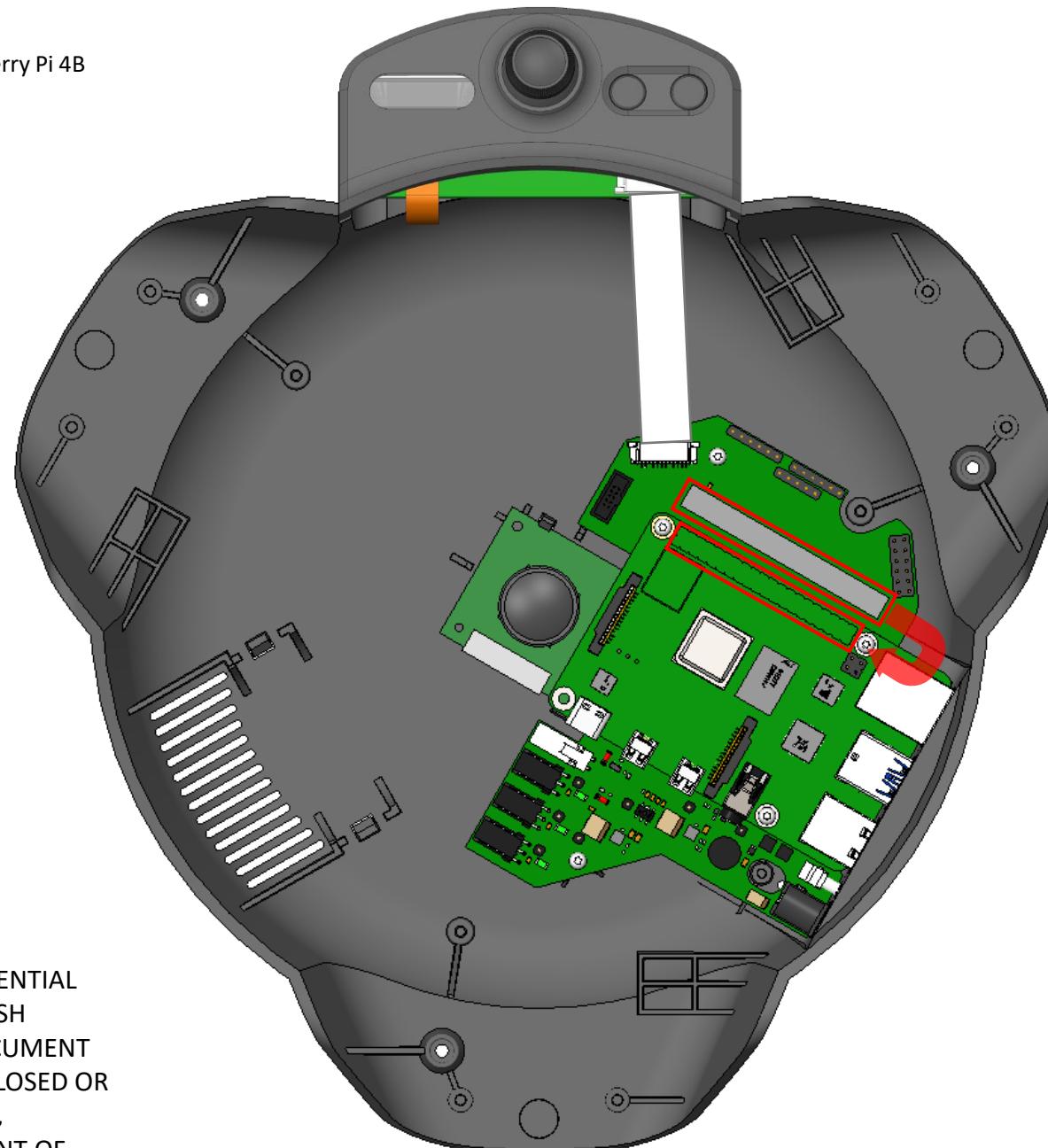


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## STEP 11

Make electrical connection from Raspberry Pi 4B to main Board with FC-HWA-00565.



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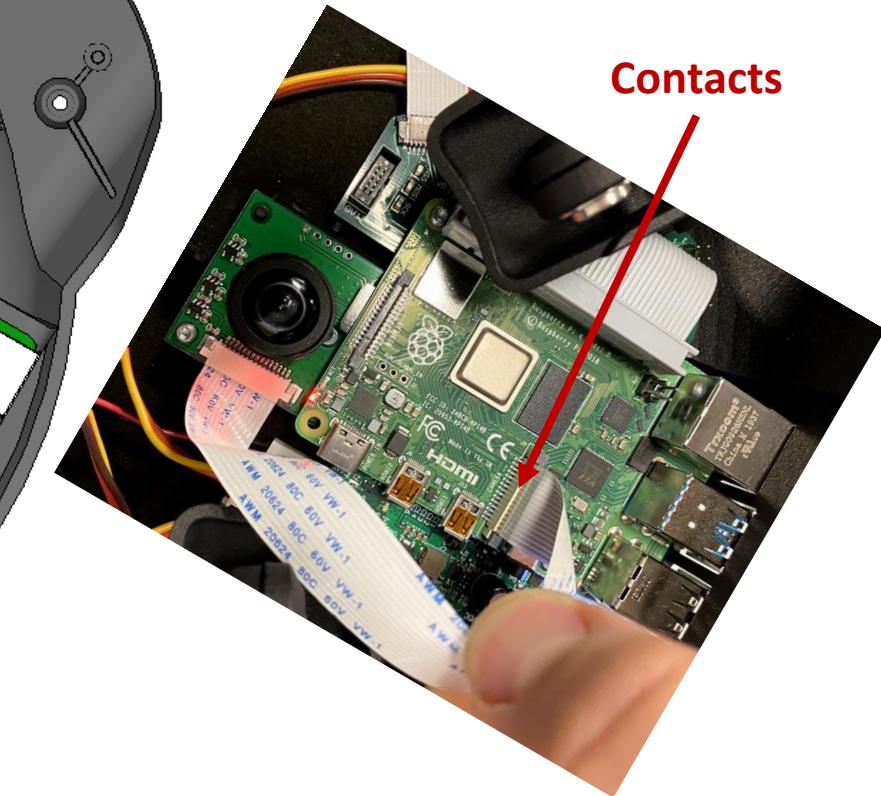
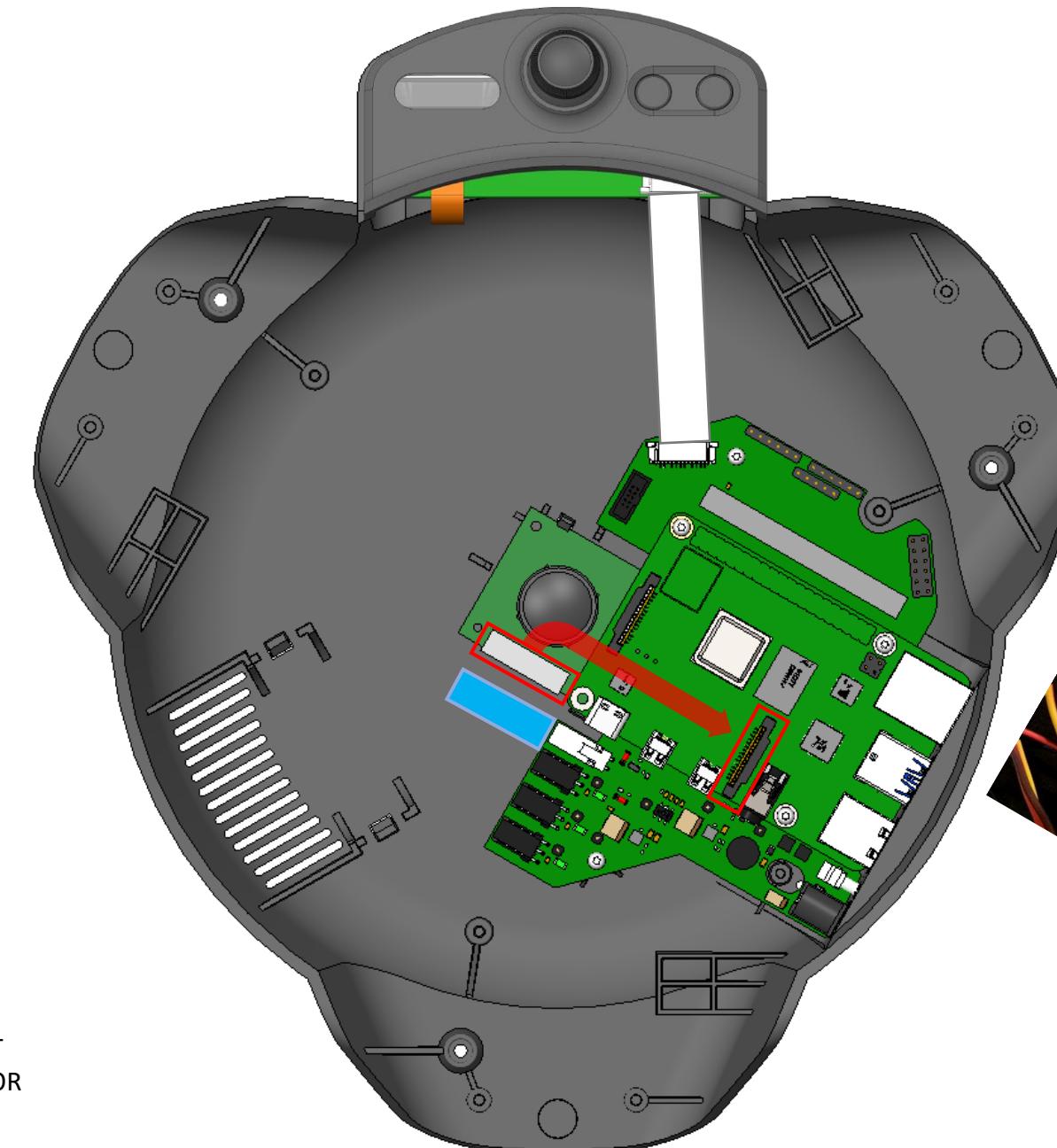
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## STEP 12

Place Ferrite (FC-HWA-00759) onto the camera's ribbon cable.

Adhere the ferrite to the indicated spot (blue rectangle) on the bottom shell with two-sided tape (FC-HWA-00743).

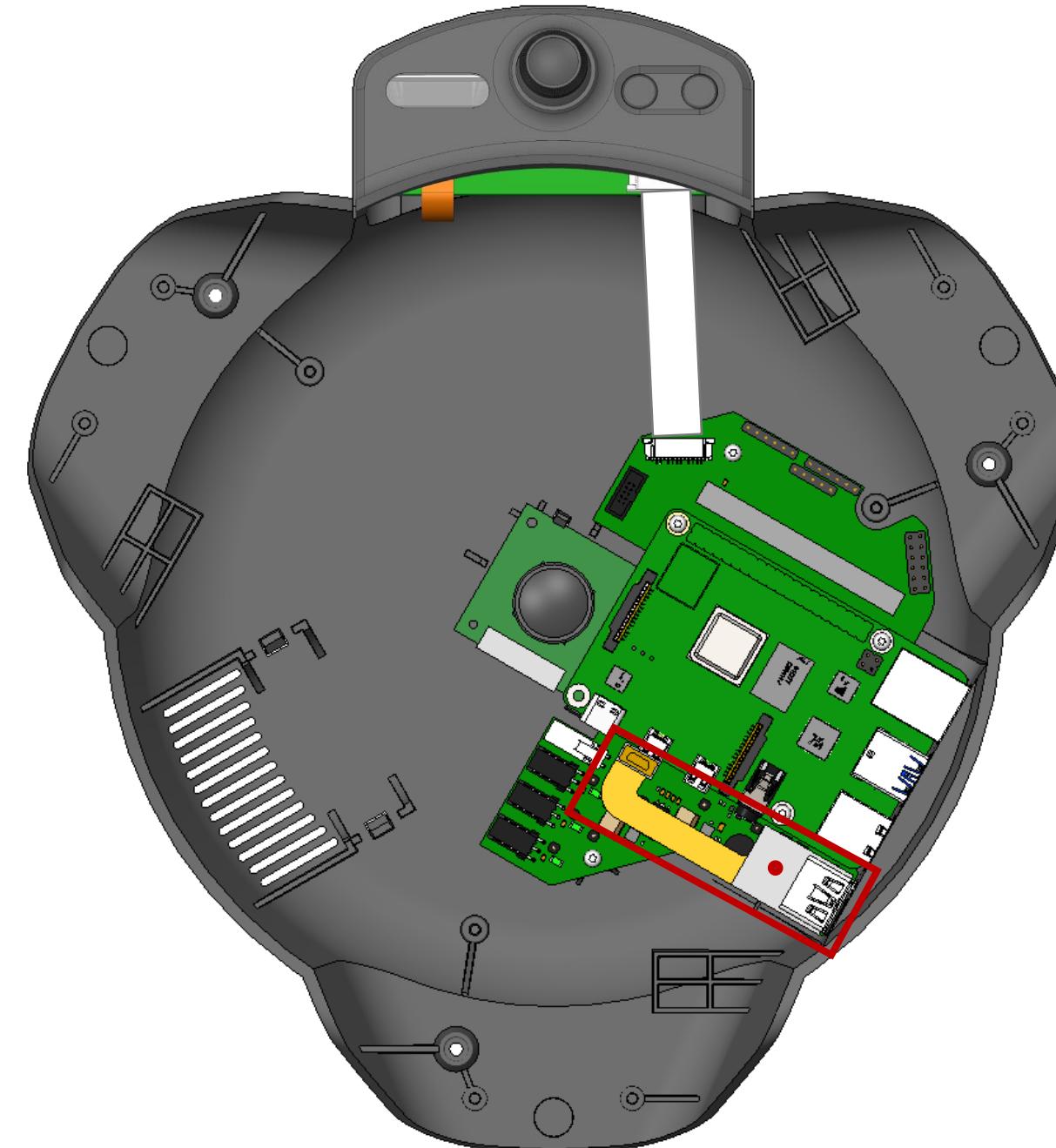
Make ribbon connection from camera to Raspberry Pi 4B. Gently lift plastic lock on Raspberry Pi port. Ensure ribbon contacts are contacting the port contacts. Press plastic lock back into the locked position.



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## STEP 13

Place HDMI Board (FC-HWA-00556) on standoff  
and align with the HDMI hole in the IO face.



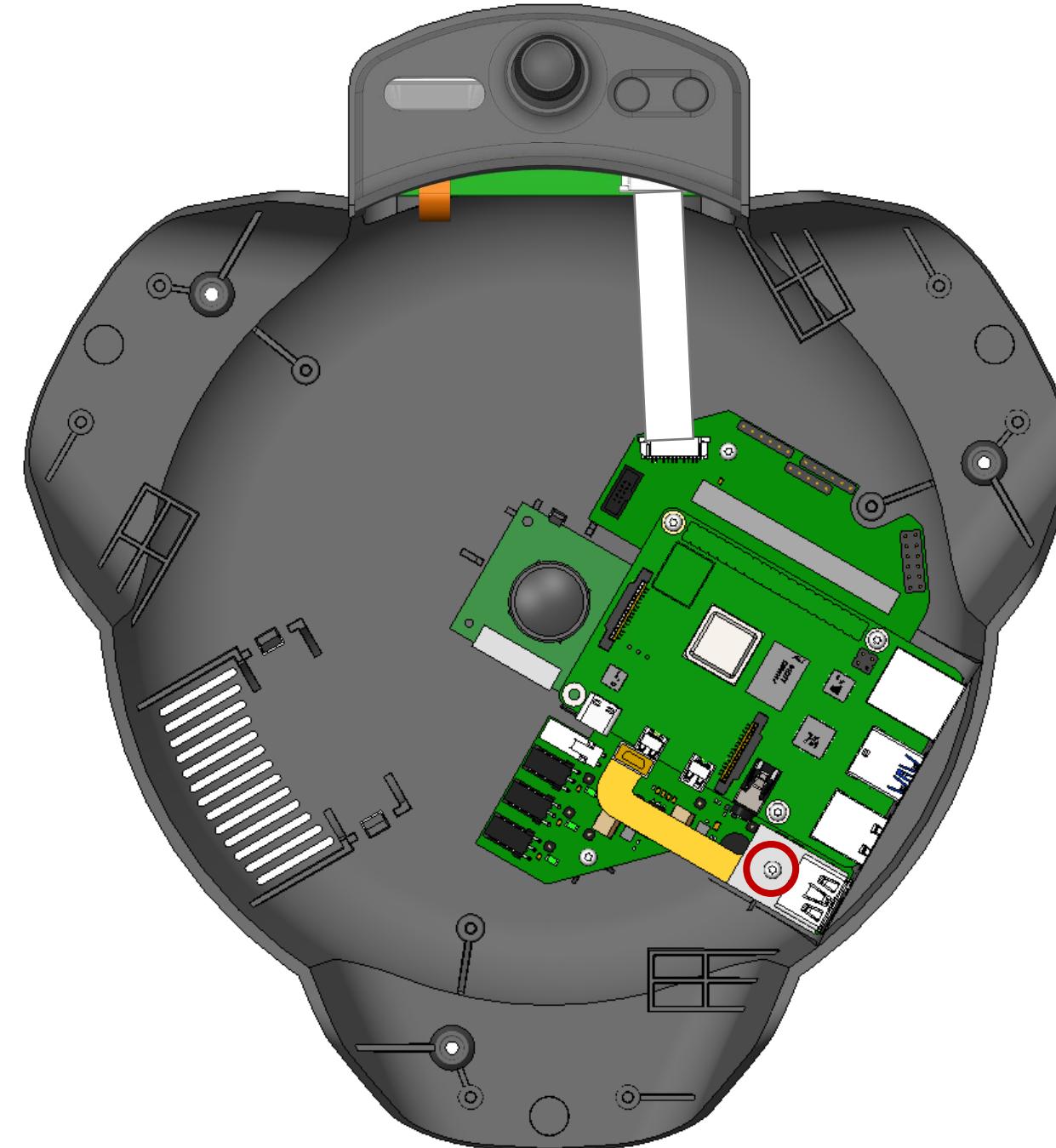
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## STEP 14

Loosely insert QTY 1 M2.5 x 8 Plastite Screw (FC-HWA-00594) through the slot in HDMI Board.

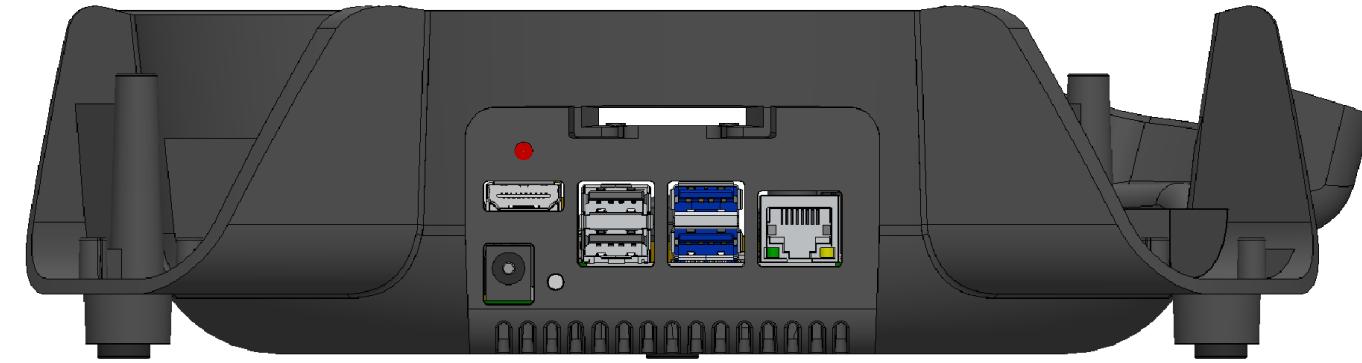


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## STEP 15

Align HDMI Board to hole in IO face.



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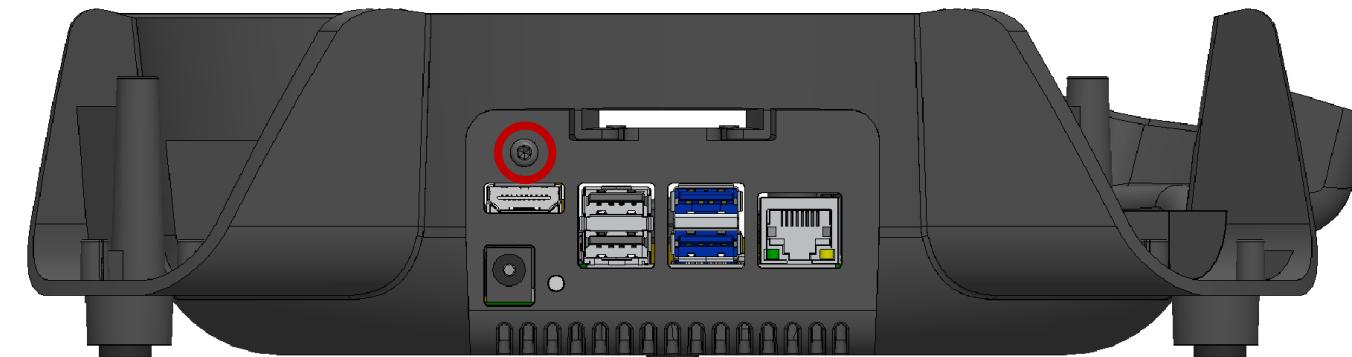
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## STEP 16

Apply a light coat Loctite 248 (FC-HWA-00747) to M3 x 8mm button head Philips machine screw (FC-HWA-00745). Avoid Loctite contacting the plastic.

Fasten HDMI Board with M3 x 8mm button head Philips machine screw. Tighten to 3 in-lb.

Note: These are individually packaged with the Servo Horns



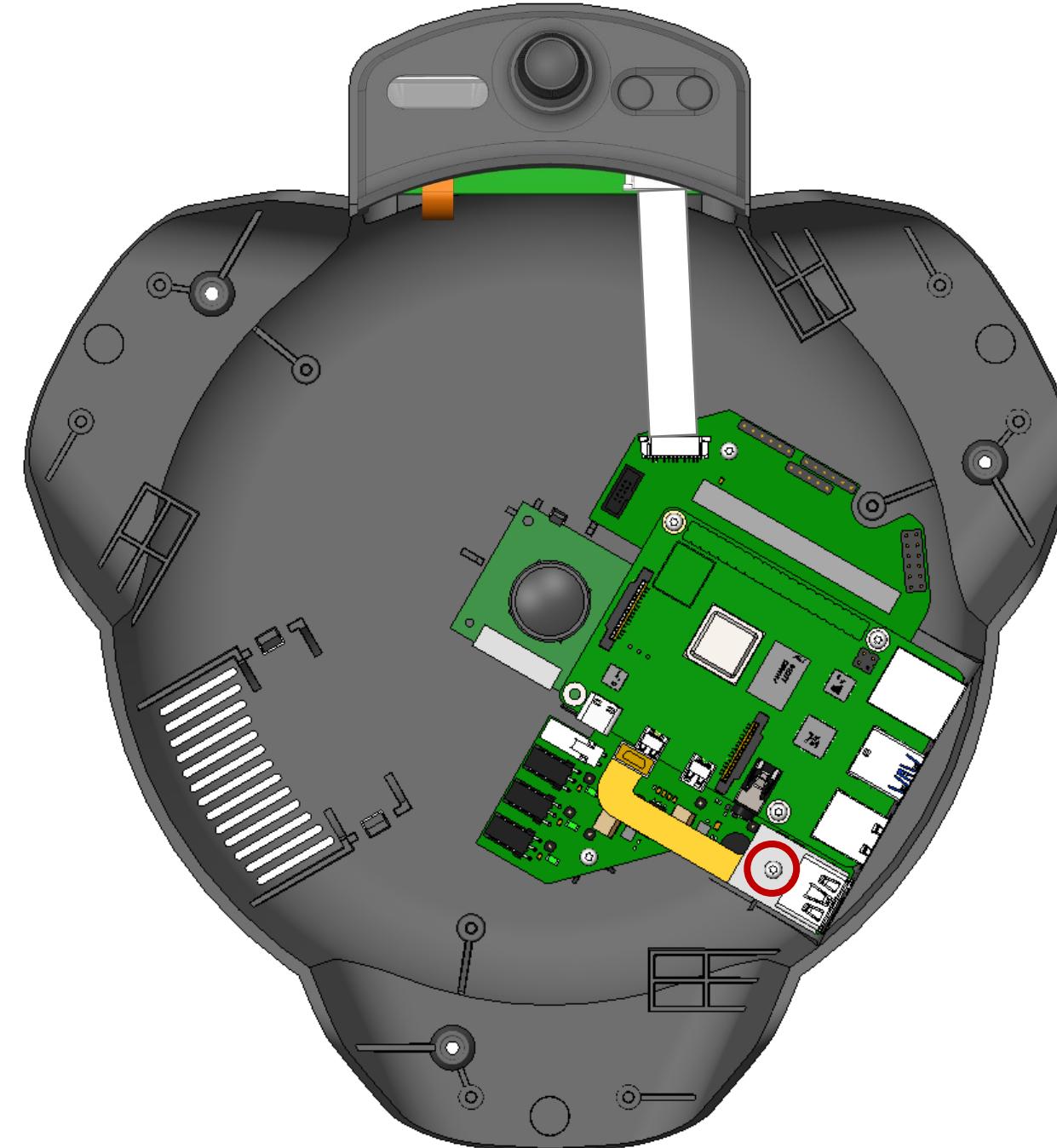
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## STEP 17

Tighten down M2.5 x 8 Plastite screw (FC-HWA-00594). Tighten to 4 in-lb.



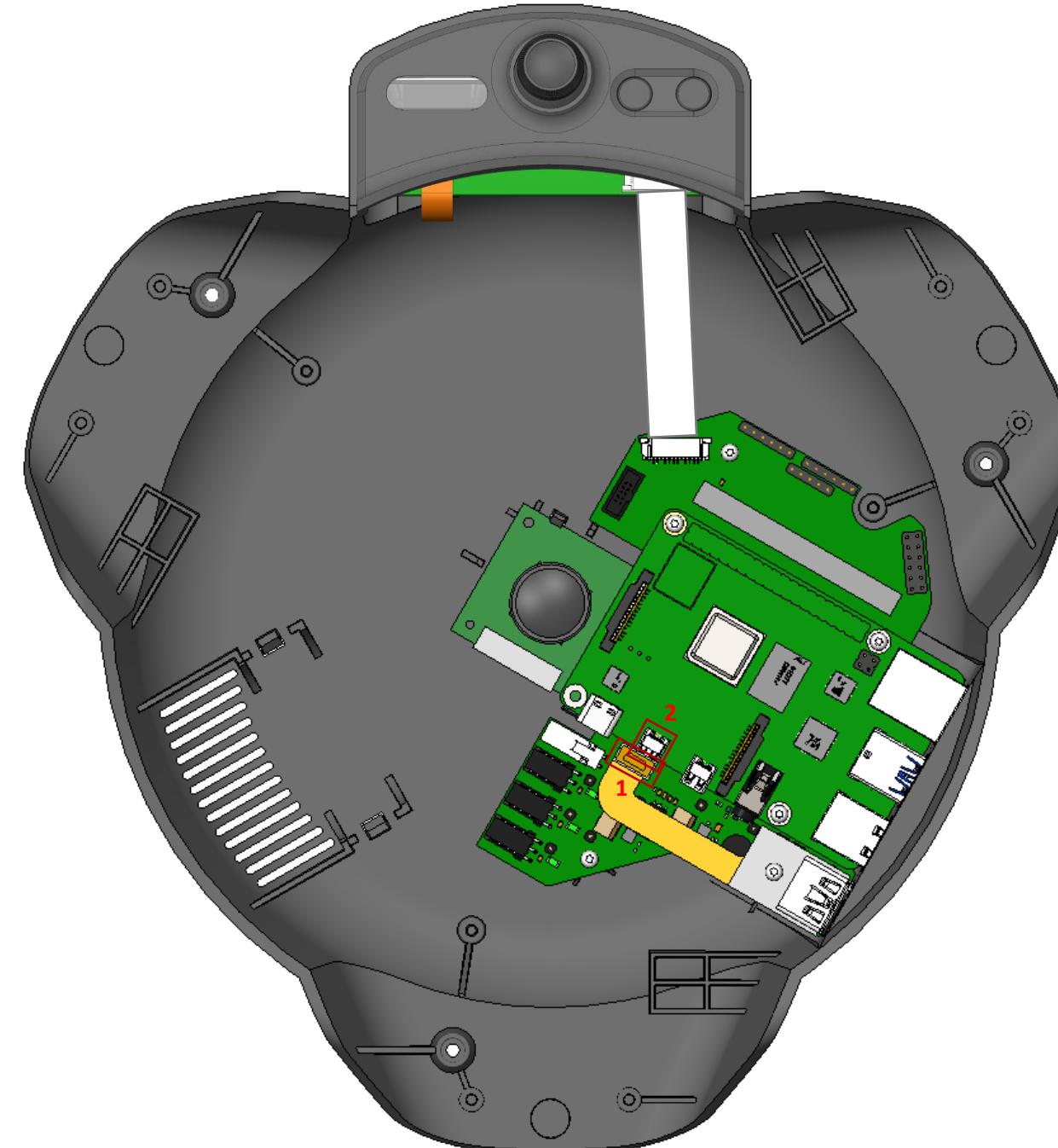
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## STEP 18

Connect micro HDMI flex adaptor **1** to indicated micro HDMI port **2**



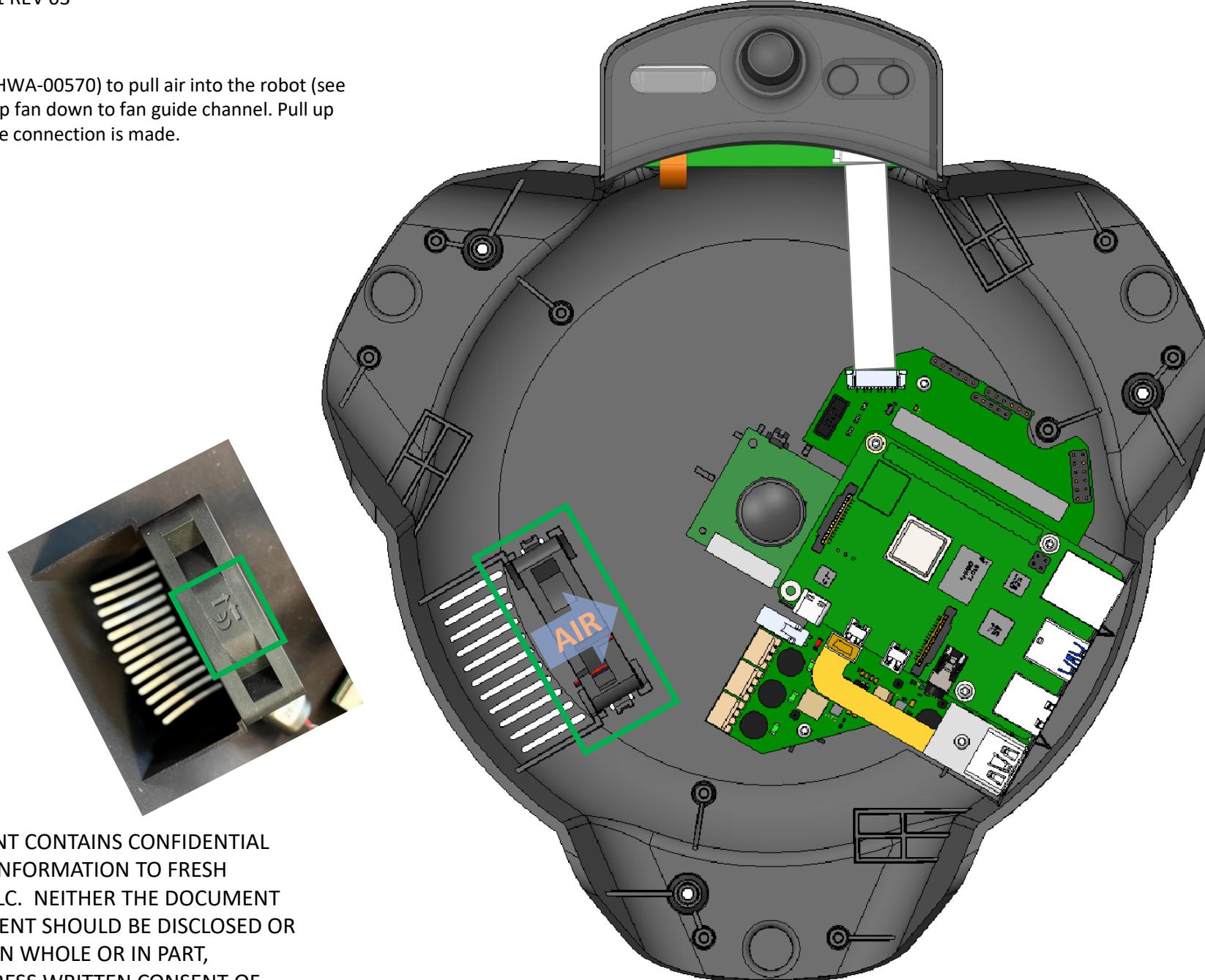
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## STEP 19

Orient fan (FC-HWA-00570) to pull air into the robot (see arrow ). Snap fan down to fan guide channel. Pull up on fan to ensure connection is made.



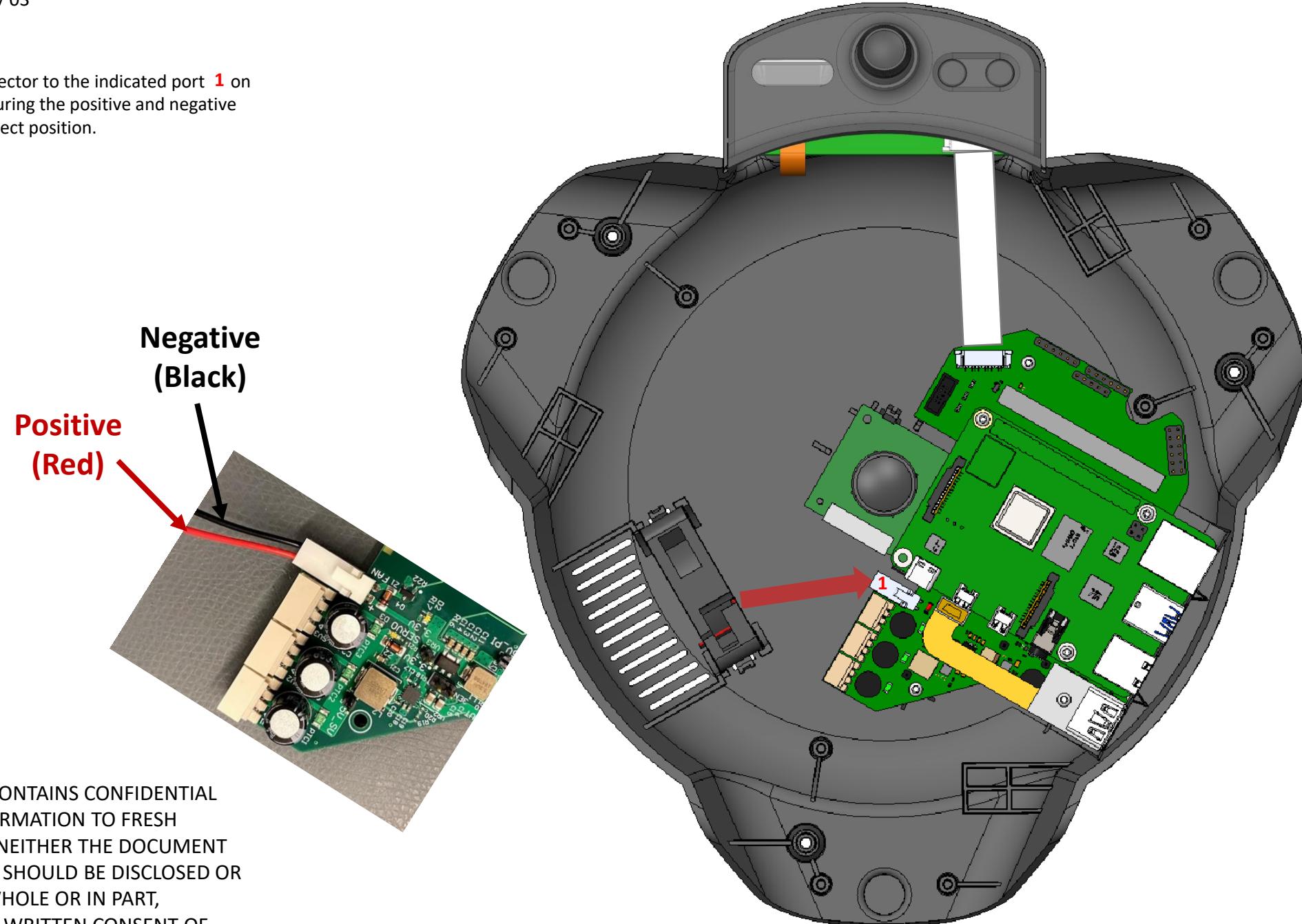
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## STEP 20

Attach the fan connector to the indicated port **1** on the main board ensuring the positive and negative wires are in the correct position.



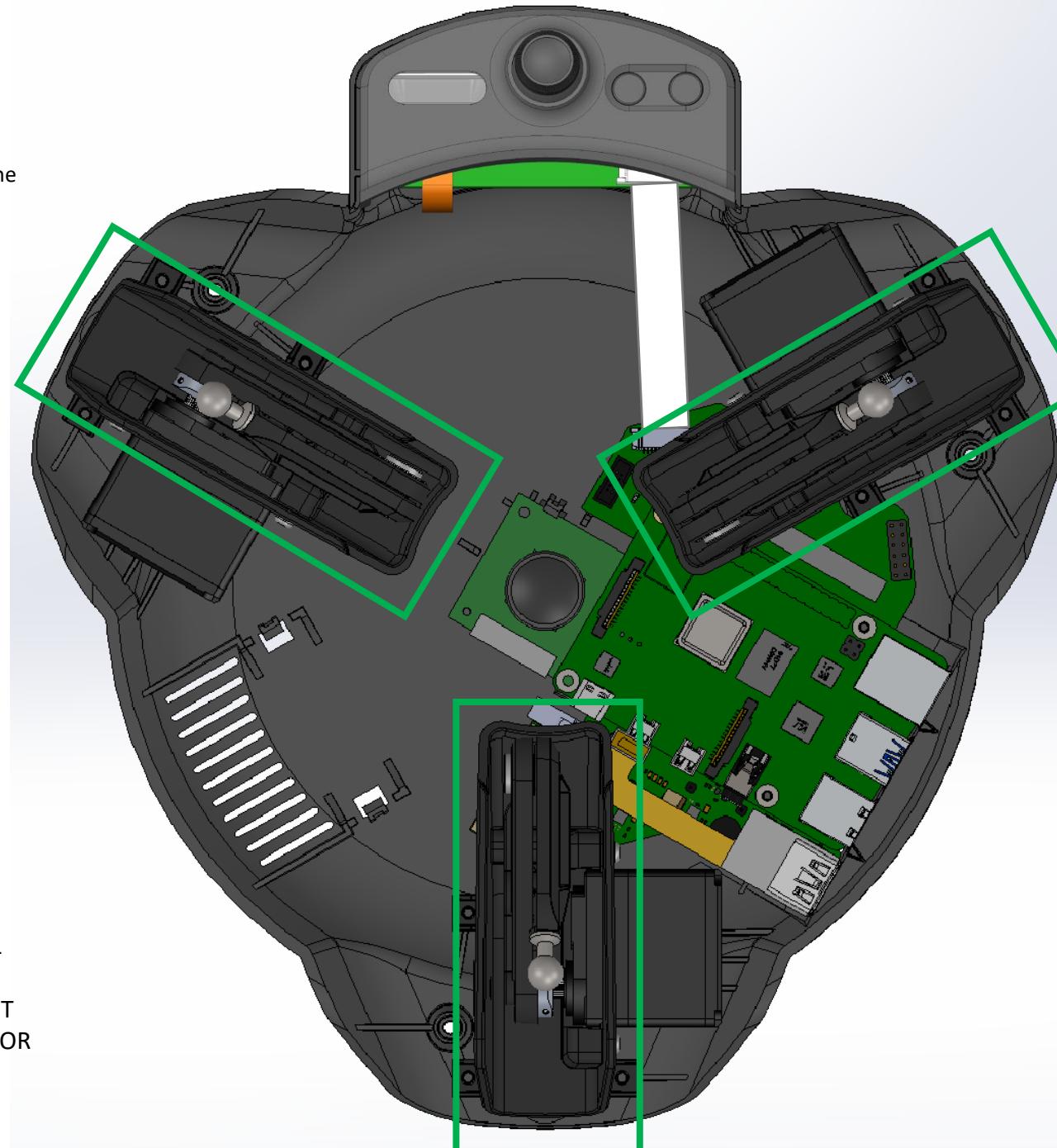
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## STEP 21

Place Servo Subassemblies (FC-ASM-00284) on mounting holes.

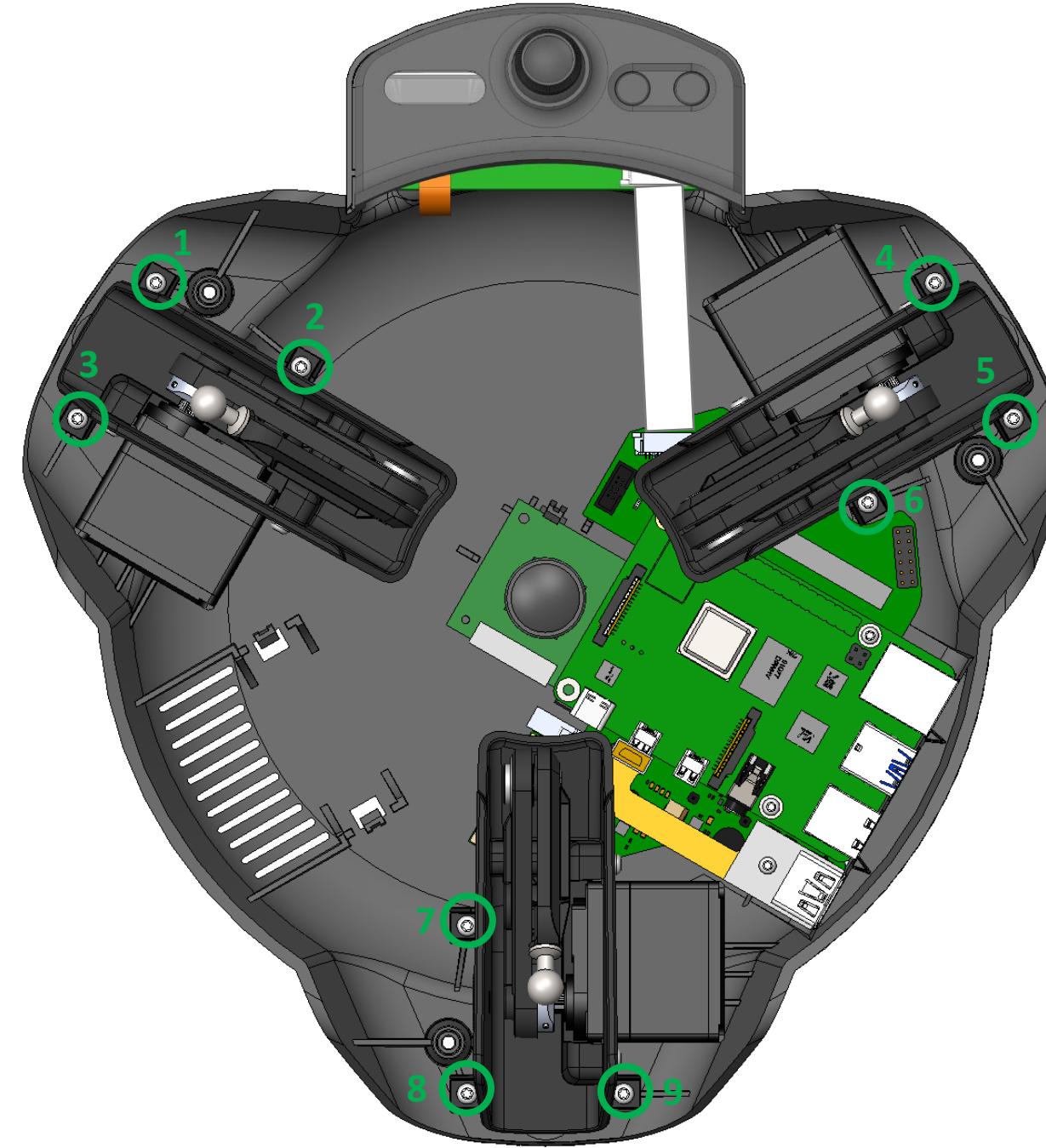
Ensure the servo wires are not pinched under the servos



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## STEP 22

Attach Servo Subassemblies with QTY 9 M3 x 10 Plastite screws (FC-HWA-00592). Tighten to 7 in-lb.



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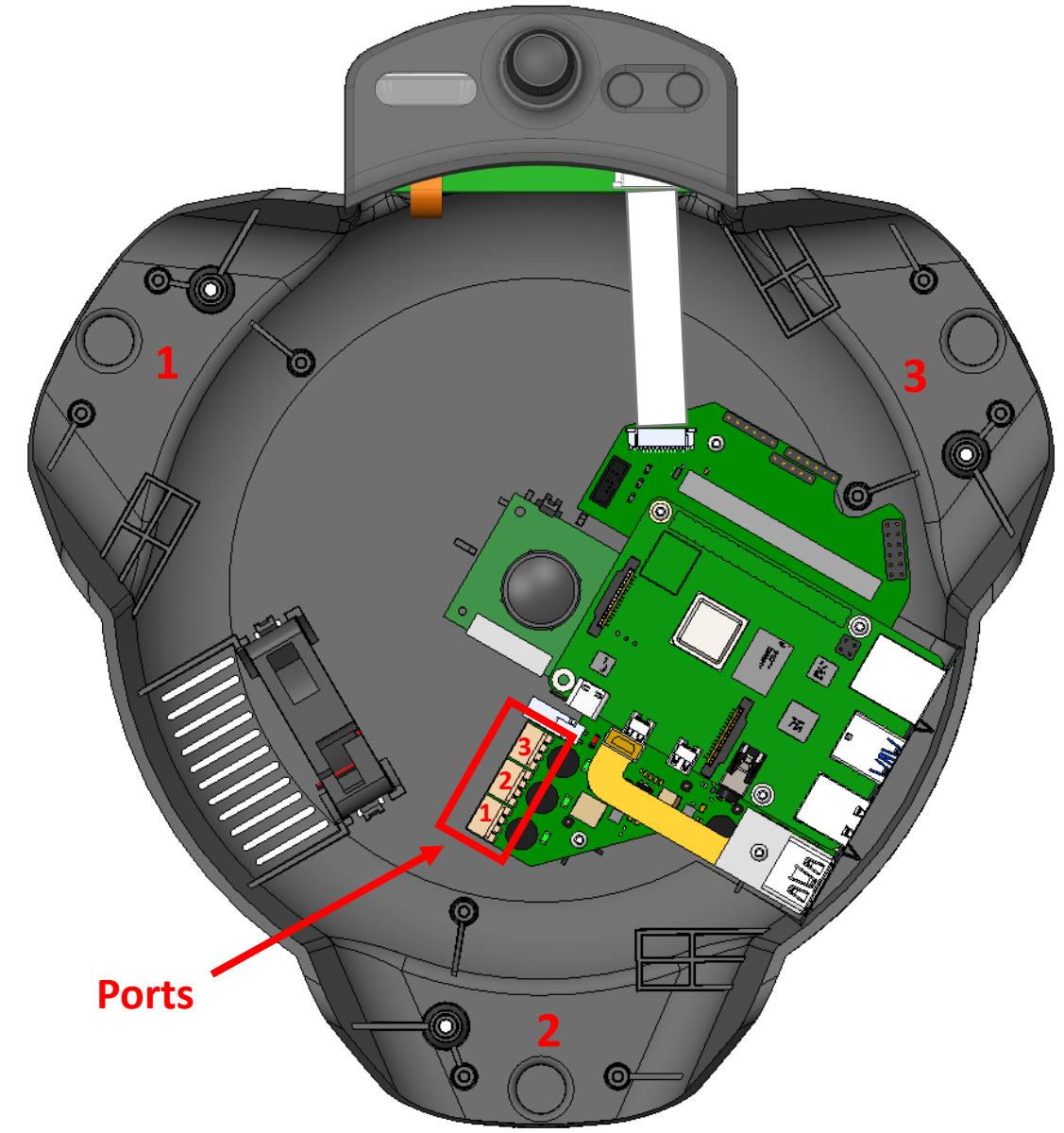
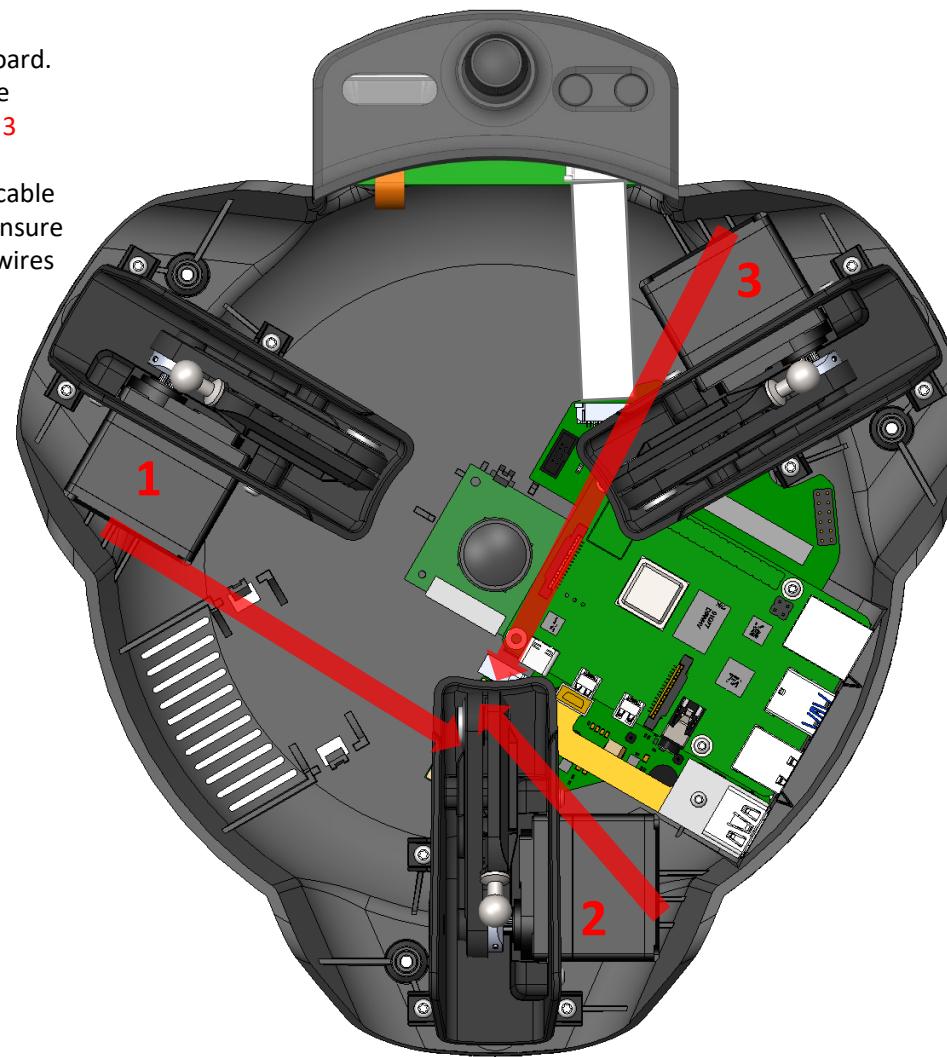


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## STEP 23

Connect Servos to Main Board.  
Ensure Servos 1, 2, & 3 are  
connected to ports 1, 2, & 3

Loop servo wires through cable  
clips (FC-HWA-00746) to ensure  
ferrites are not loose and wires  
cannot contact the fan.



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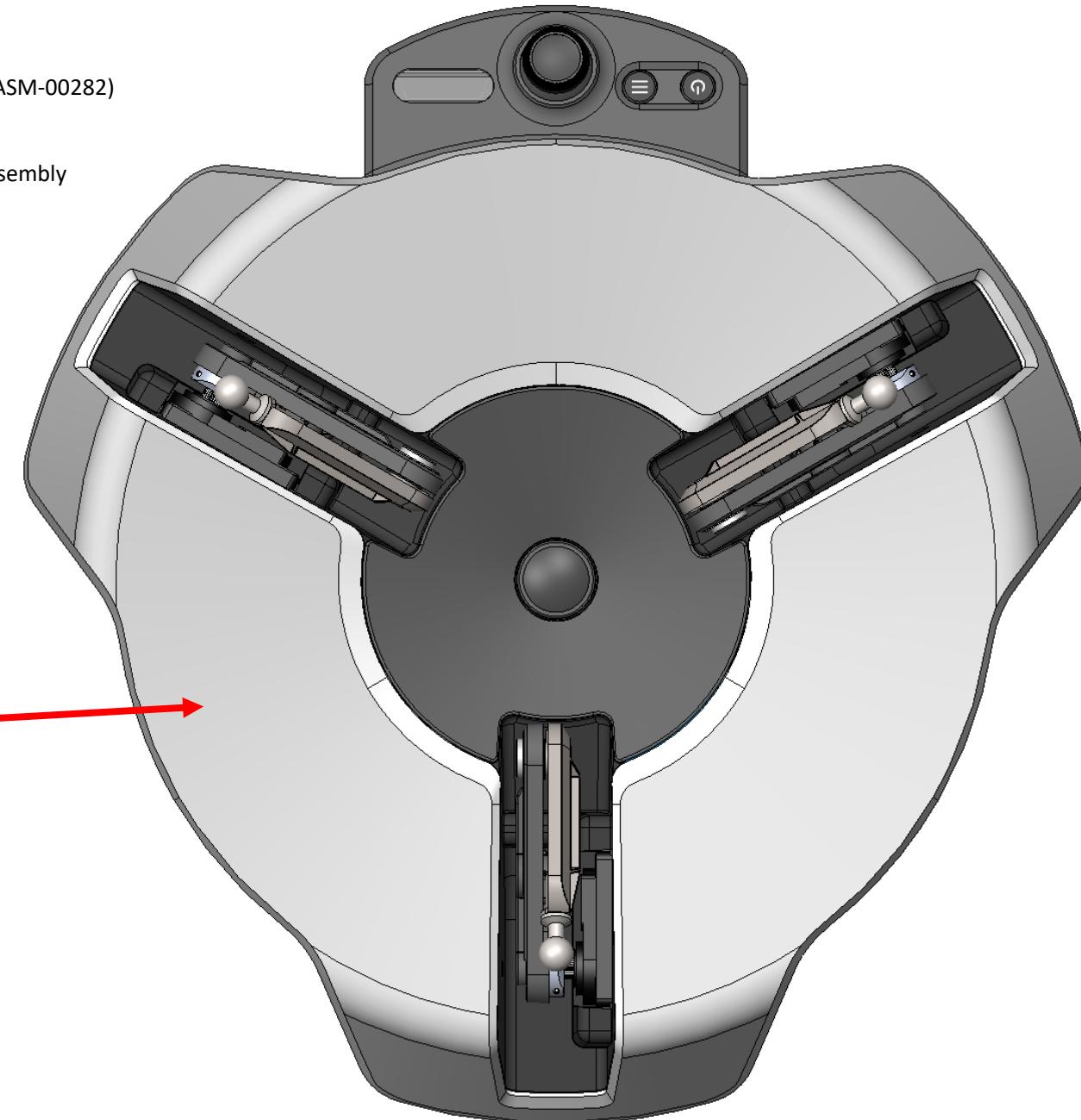
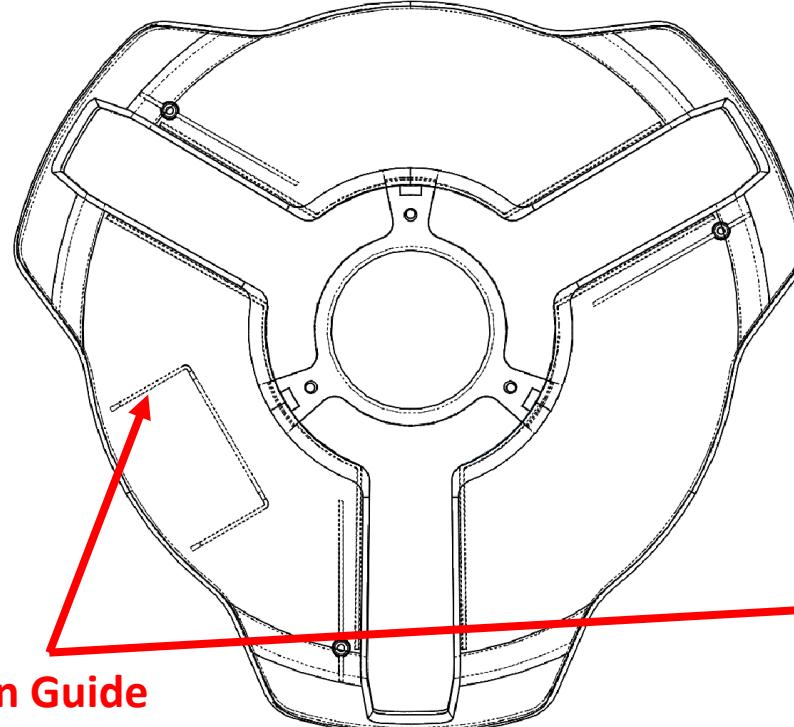
Conduct Servo Calibration and Production Software Initialization starting on Page 7 of the Moab Production Test Procedure (03252-DOC-INS02)



## STEP 24

Place Top Cover Subassembly (FC-ASM-00280) on Bottom Subassembly (FC-ASM-00282)  
making sure to align fan guides to fan.

Save plastic bag that the Top Cover was packaged in for the Balance Plate Assembly



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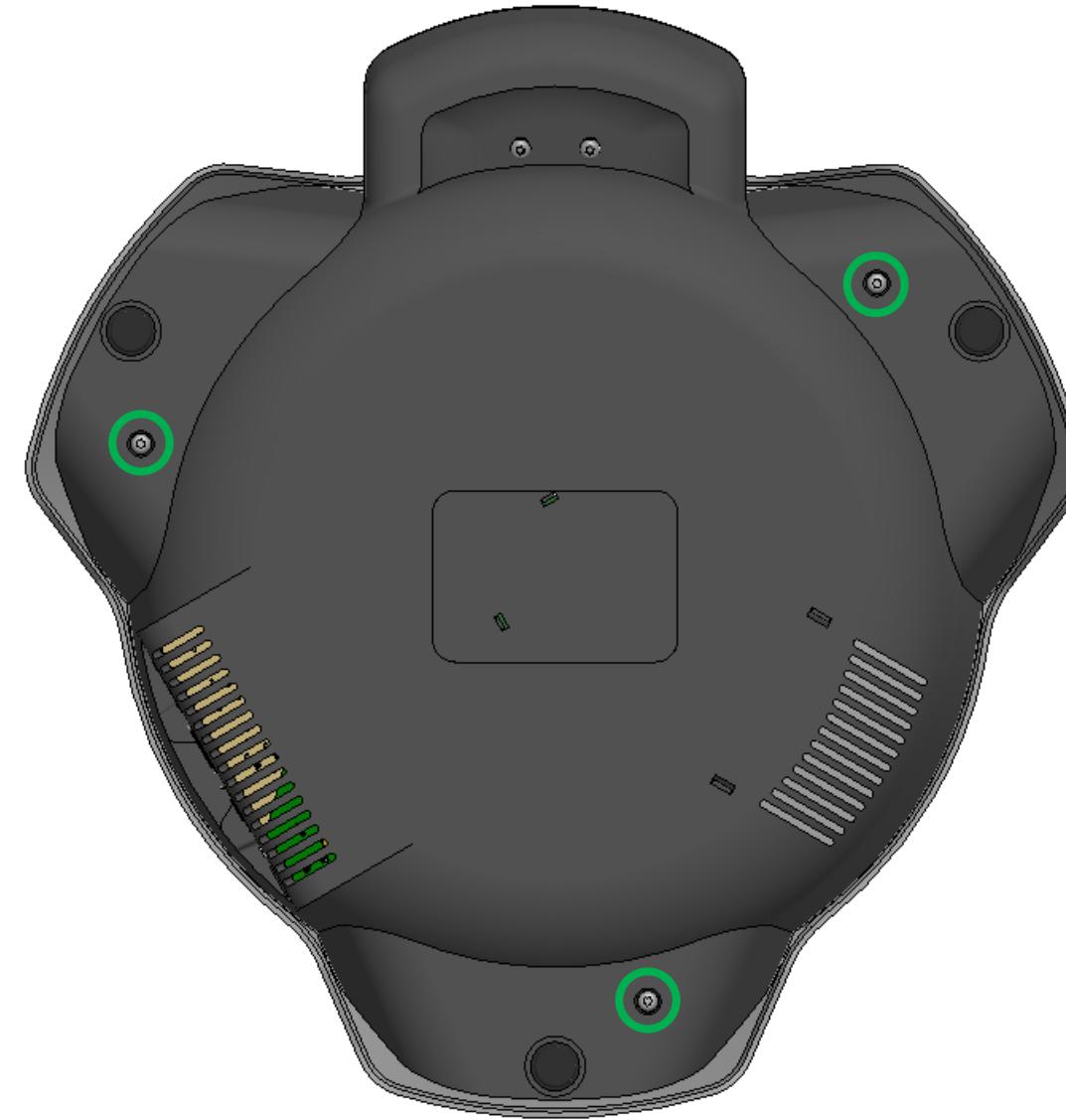


Conduct Final Software Checkout on Page 14 of the  
Moab Production Test Procedure (03252-DOC-INS02)



## STEP 25

While holding Top Cover in place, fasten with QTY 3 M3 x 10mm Plastite screws (FC-HWA-00592). Tighten to 7 in-lb



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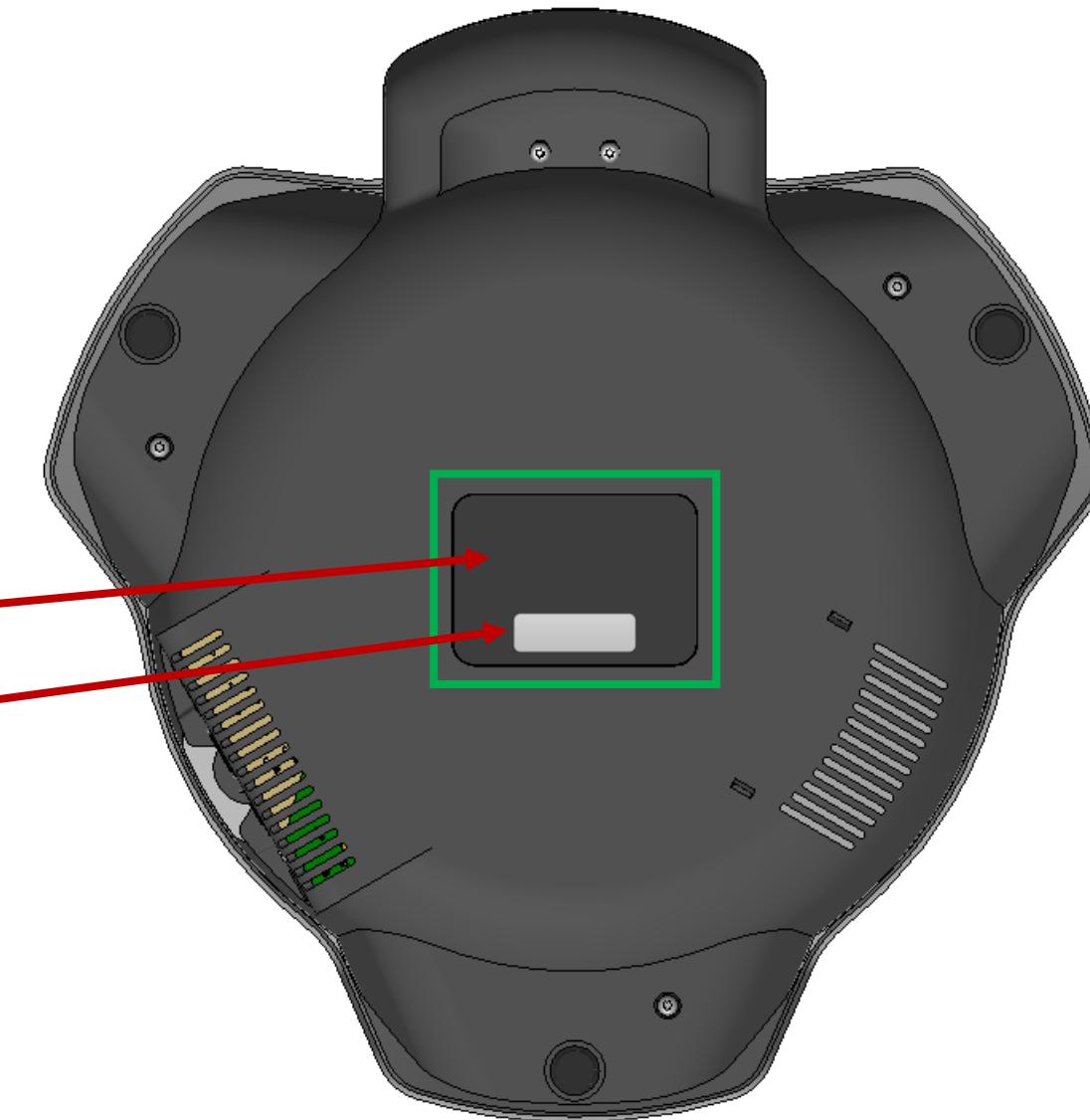
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## STEP 26

Place Product Label (FC-HWA-00559) in cutout on bottom of bot.

Place the Barcode Label centered on the blank bottom section of the Product Label

Print Barcode Label for package, place with bot



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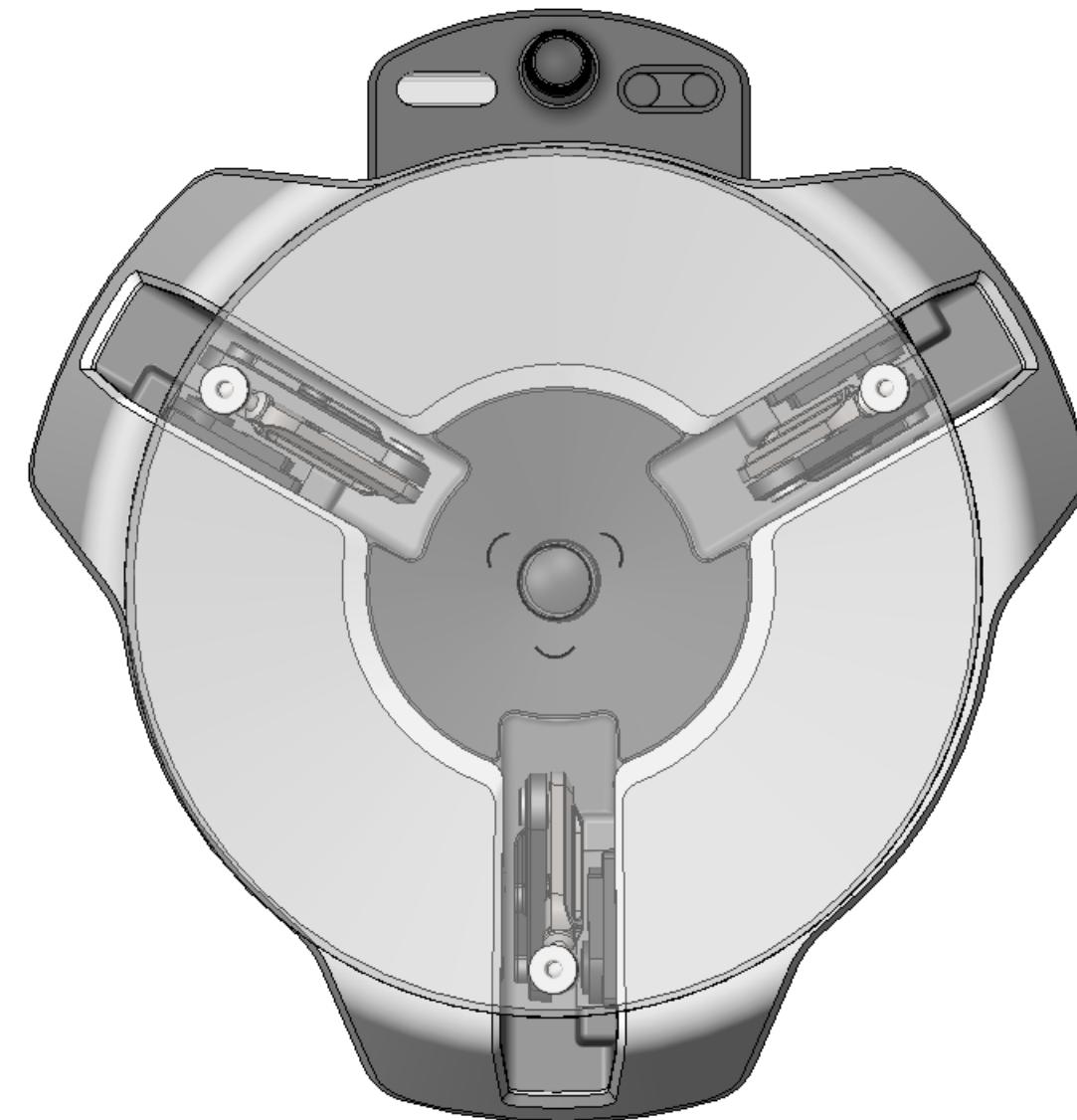
# Packaging

## STEP 1

Remove the blue plastic from the Balance Plate

Wrap the Balance Plate Assembly in a plastic bag  
that the Top Cover came in.

Place Balance Plate Assembly onto pillow balls in  
the servo arms.



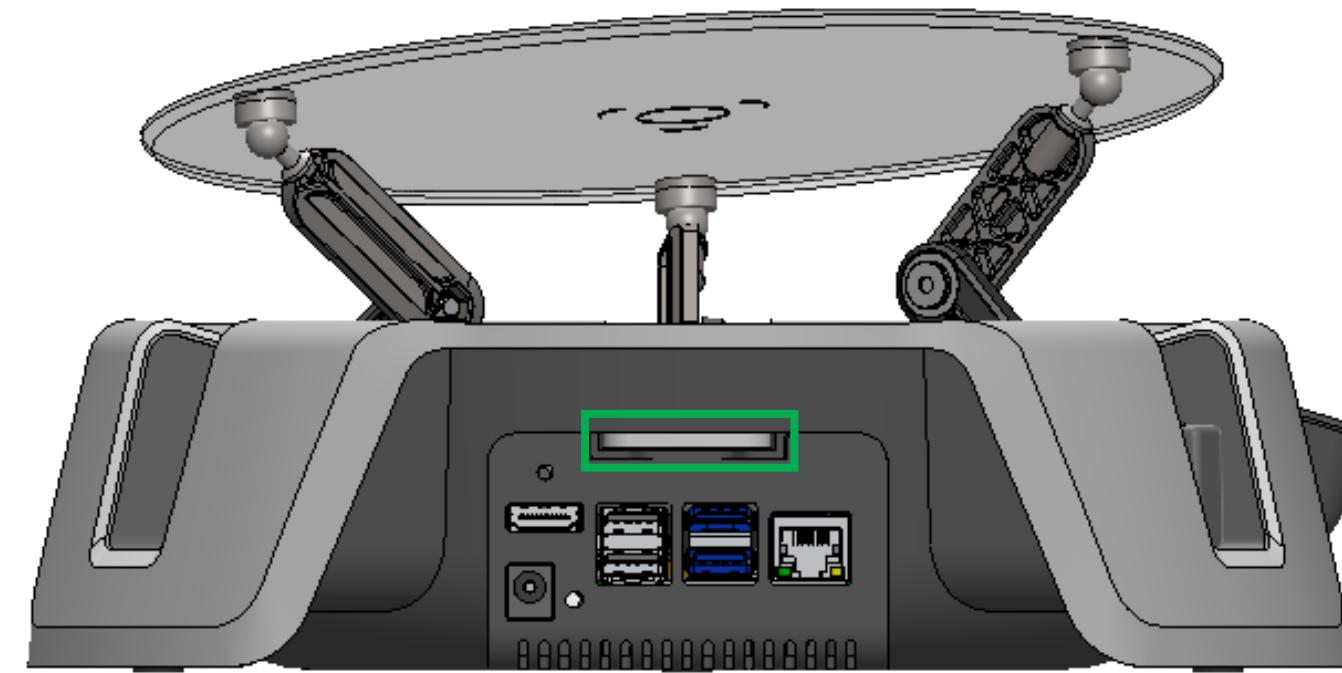
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## STEP 2

Insert Calibration Tool (FC-HWA-00595) into cutout in IO face.

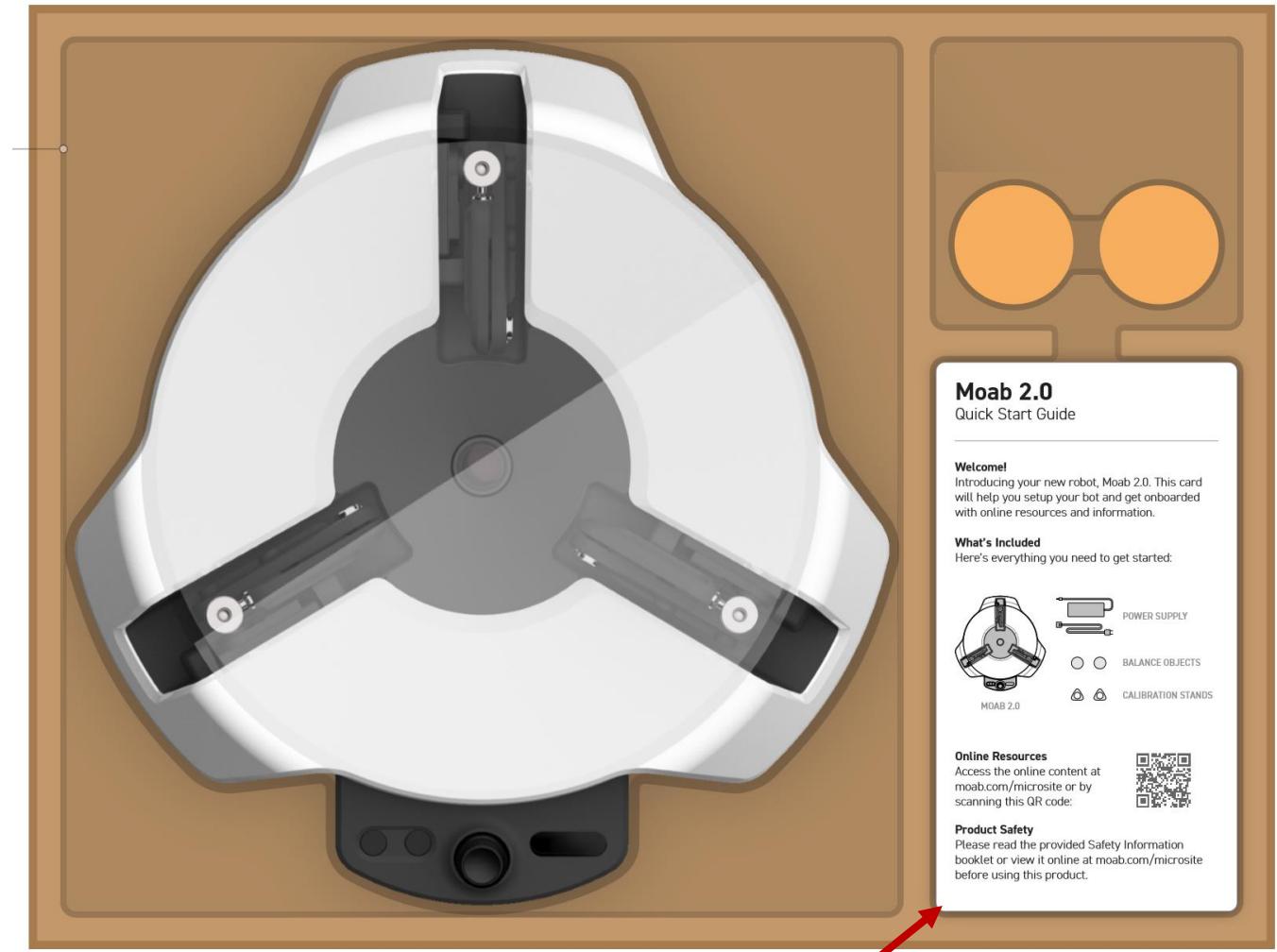


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## STEP 3

Place the unit into the box as shown. Ensure to include the second calibration tool (FC-HWA-00595), power supply (FC-HWA-00597), balls (FC-HWA-00596), Safety Booklet (FC-HWA-00647), and Quick Start Guide (FC-HWA-00601).



**Power Supply and Extra Calibration Tool Goes Under Quick Start Guide**

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