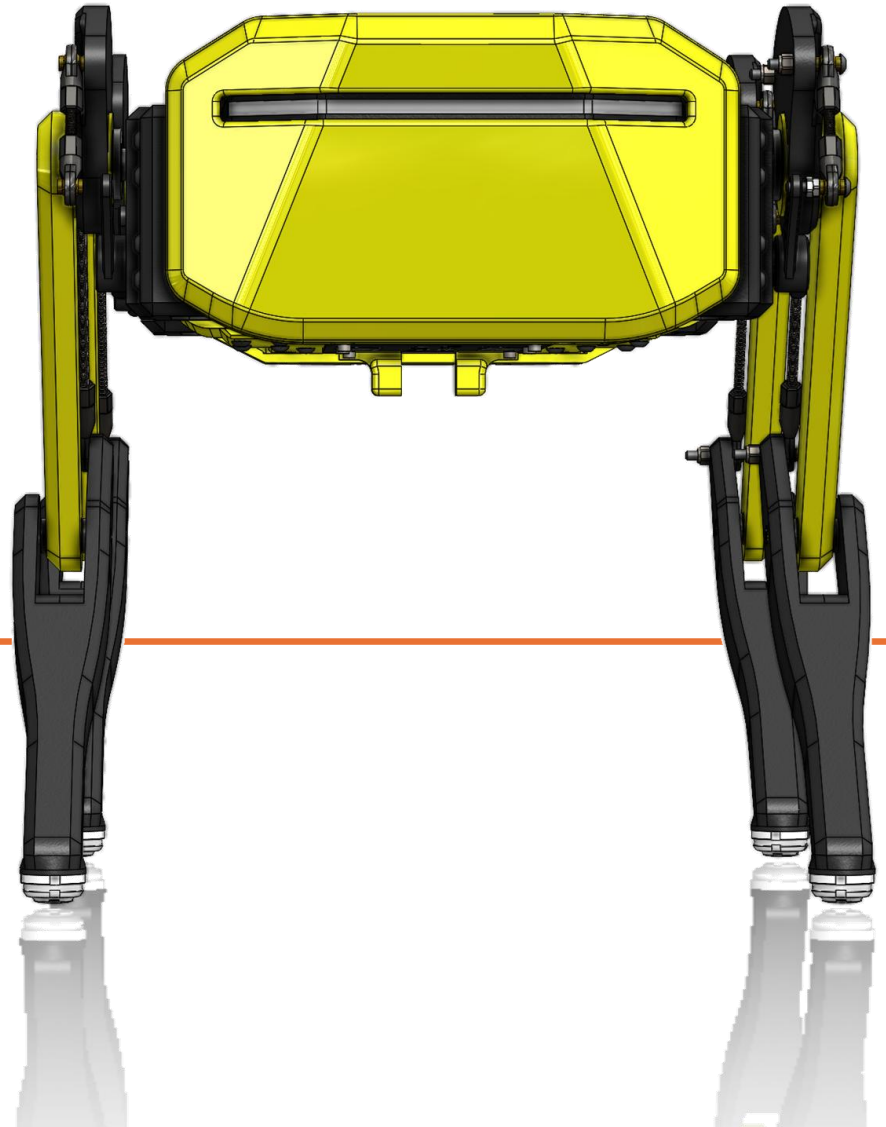
Quadruped II

- Assembly Guide



Quadruped v1.15

Print guidelines

Material

PC, ASA, ABS, PETG, PLA
PC-CF, PA-CF, ABS+, ABS-CF
TPU (For feet only)

Carbon Fiber variants are expensive but provides a lot of rigidity.
PC and ASA are preferred but required a good printer with an enclosure to print reliably.
PETG and PCTG are good “budget” filaments.

Infill
15-35%
Gyroid / Honeycomb / Triangle / Cubic

Organic supports from Baseplate only if necessary.
Not needed for all parts.

Perimeter
Layer Height - 0.2mm
Perimeter: 4
Wall: 4
Solid Top/Bottom: 5

Tools

Soldering Iron - TS101	AliExpress Link	Amazon Link	*(Recommended)*
Heat Insert Kit for TS101	AliExpress Link	Amazon Link	*(Recommended)*
Electric Precision Screwdriver	AliExpress Link	Amazon Link	*(Recommended)*
Torque Screwdriver	AliExpress Link	Amazon Link	
Wire Stripper	AliExpress Link	Amazon Link	
Allen Key Set	Aliexpress Link	Amazon Link	
Torx Key Set	Aliexpress Link	Amazon Link	
Heat Insert Press Tool	Aliexpress Link	Amazon Link	
Crimp Tool	Aliexpress Link	Amazon Link	
Soldering Iron - Generic (Alternative)	Aliexpress Link	Amazon Link	*Budget friendly alternative*
Heat insert tip - set (Alternative)	Aliexpress Link	Amazon Link	*Budget friendly alternative*
Precision Screwdriver Set	Aliexpress Link	Amazon Link	*Budget friendly alternative*

These are the tools I consider must have for this project.
I have tools listed in the BOM with a larger variety of budgets

Fasteners & Misc

Heat insert set	Aliexpress Link	Amazon Link
Wire - Power	Aliexpress Link	Amazon Link
Wire - Communication / Signal	Aliexpress Link	Amazon Link
M3 Button Cap Screw set	Aliexpress Link	Amazon Link
M3 Torx Screw Set	Aliexpress Link	Amazon Link
M3 Socket Head Cap screw set	Aliexpress Link	Amazon Link
Ferrules Set	Aliexpress Link	Amazon Link
Reusable Velcro Cable Ties	Aliexpress Link	Amazon Link

Filament

PC / ASA / ABS / PETG	Aliexpress Link	Amazon Link
Engineering Grade Filaments	Aliexpress Link	Amazon Link
PLA	Aliexpress Link	Amazon Link
TPU	Aliexpress Link	Amazon Link
PC / ASA / ABS / PETG	Aliexpress Link	Amazon Link
Engineering Grade Filaments	Aliexpress Link	Amazon Link

Tightening Torque

When applying preload to a screw you are setting a torque on the screw itself.
It determines how elongated the screw will become. It essentially works like a spring to make sure it won't come lose.

The nominal torque is a set of values calculated on the surface friction and thread size of the screw. I will only list the necessary torque if you want to invest in a torque screwdriver
It also depends on the screw itself.
Is it Stainless steel, or 8.8, 10.9 hardness.

The most common ones are stainless steel and Electro-zink plated 8.8.

- **Tightening Torque M2: 0.6Nm-0.9Nm**
- **Tightening Torque M3: 1.5Nm-3.0Nm**

Heat Inserts

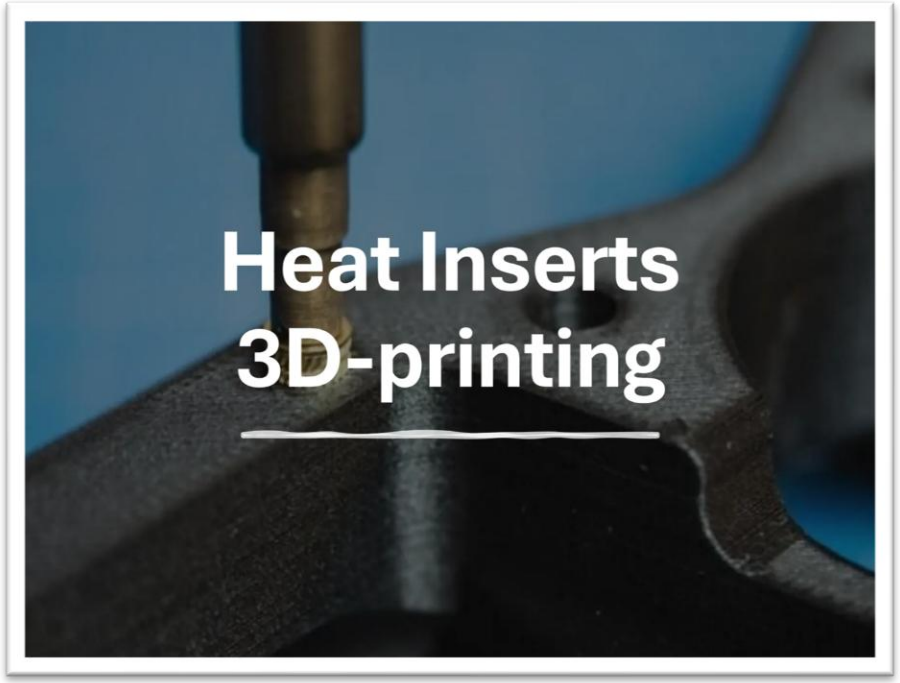
How-To

Heat Inserts

Heat inserts in 3D-printing is one of the ways to create threads for fasteners.
M2 and M3 threads are generally quite hard to print.
Another benefit is that it gives the details a professional look to them.

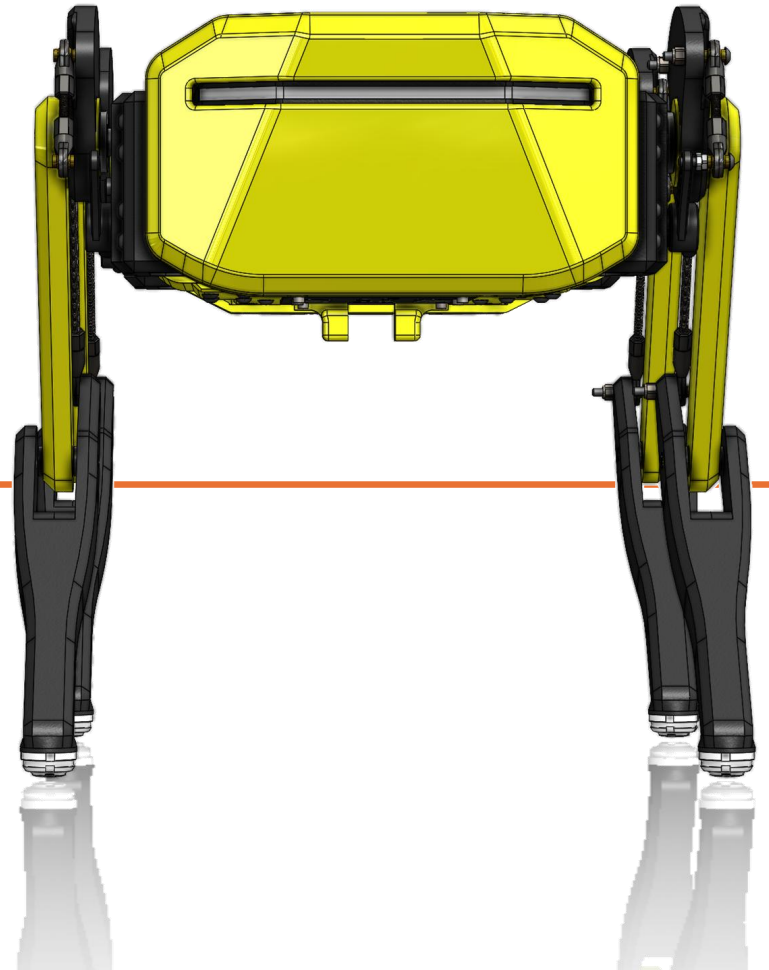
https://www.printables.com/article/heat-inserts-and-3d-printing-a-guide-W5ob2VN

Don’t worry, it’s not difficult!



Lets Start!

Refer to the Bill of Material for the full list of components

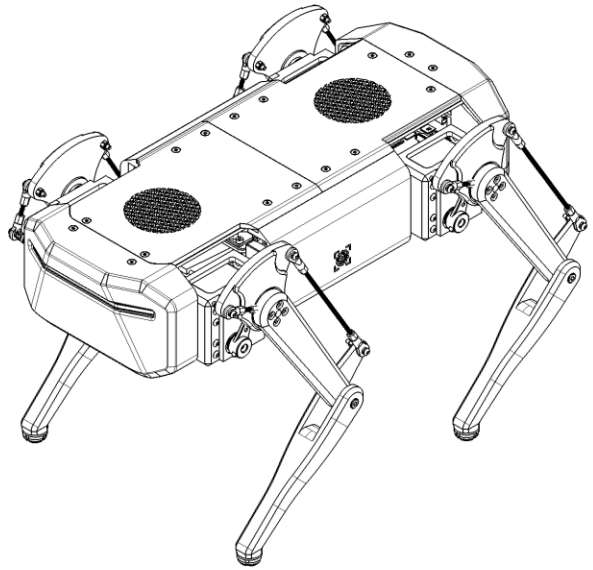


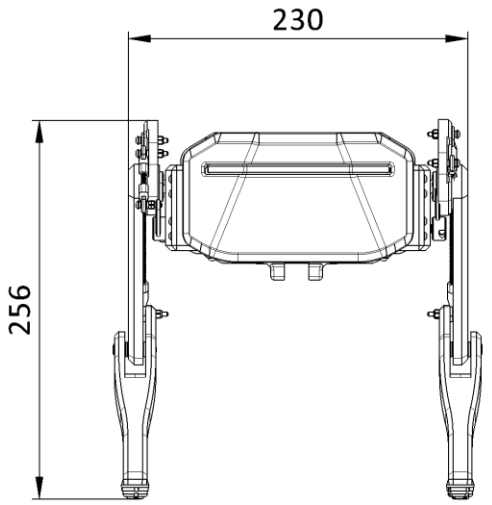
Assembly

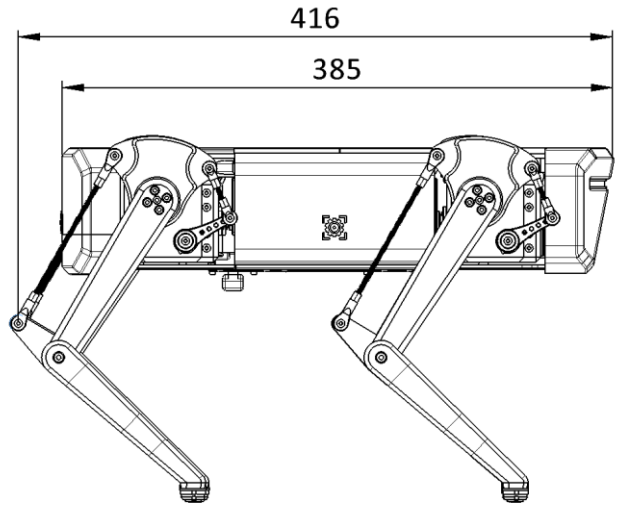
Quadruped II - Complete

Main Assembly

Item	Qty.	Description	Article No.
1	1	Left Side Complete	0001-0200 LeftSide_Complete
2	1	Right Side Complete	0001-0300 RightSide_Complete
3	1	Bottom Assembly	0001-0900 Bottom_Assembly
4	1	Rear Fan Assembly	0100-1000 Rear_Fan_Assembly
5	1	Front Fan Assembly	0100-1000 Front_Fan_Assembly
6	1	Front Cover	0001-0101 FrontCover
7	1	Back Cover	0001-0102 BackCover
8	1	Top Front Cover	0001-0103 Top_Front
9	1	Top Rear Cover	0001-0104 Top_Rear
10	1	Top Structural Support	0001-0105 Top_Structural_Support
11	16	Heat Insert	M3x5x3 Heat insert
12	4	Socket head cap screw	MC6S, M4x16H
13	4	K6S - M3x10	K6S - M3x10
14	28	Countersunk head cap screw	MF6S M3x8H
15	1	3D Printed Part	0001-0906 LCD_bracket
16	1	1.47" LCD	LCD Display
17	4	Socket head cap screw	MC6S M2x6F_A2
18	4	Socket head cap screw	MC6S, M3x14H
19	4	Socket head cap screw	MC6S, M3x10H







Assembly

0001-0200 LeftSide_Complete

Instructions for assembling the Left Side.
Refer to the BOM when referencing the item numbers.

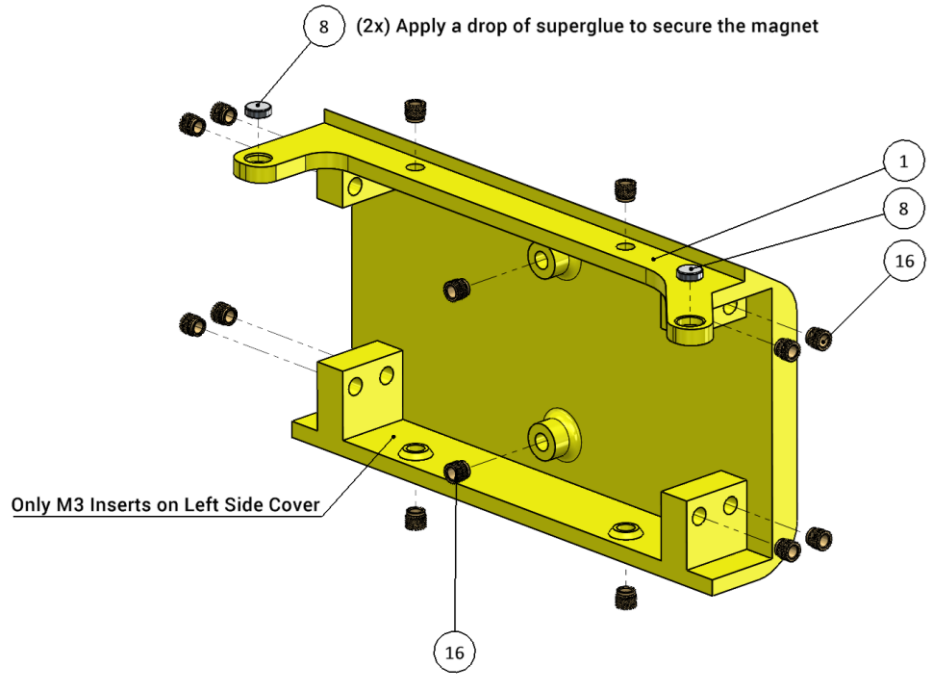
Item	Qty.	Description	Article No.
1	1	Left side Cover	0001-0201 LeftSideCover
2	2	Left side Servo Housing	0001-0202 LeftServoHousing
3	2	Servo Bracket	0001-0203 ServoMotor_Bracket
4	2	Leg Assembly	0001-0600 LeftLeg_Assembly
5	2	Servo Disc	Servo Disc
6	2	Washer with large O.D	RBS, M3 (3,2x9x0,8)
7	6	Servo Motor	35kg servo
8	2	Neodymium Magnet	6X2 MAGNET
9	1	Terminal Shield	Arduino NANO Terminal Adapter
10	1	Micro Controller	arduino nano
11	8	Countersunk head cap screw	MF6S M3x8H
12	10	Socket Head cap screw	MC6S, M3x8H
13	2	Socket Head cap screw	MC6S, M3x10H
14	16	Button Head Cap Screw	K6S - M3x16
15	2	Heat insert	m4x6x4 Heat Insert
16	14	Heat Insert	M3x5x4 Heat insert

Heat Inserts

0001-0201 LeftSideCover

Start with inserting the Heat Inserts.
The Left Side Cover only uses M3 heat inserts.

Use some adhesive like superglue in the seating for the magnets

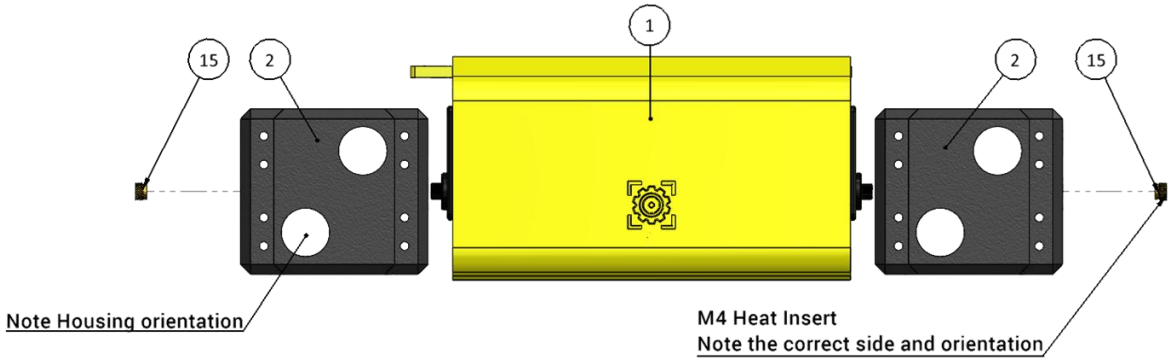


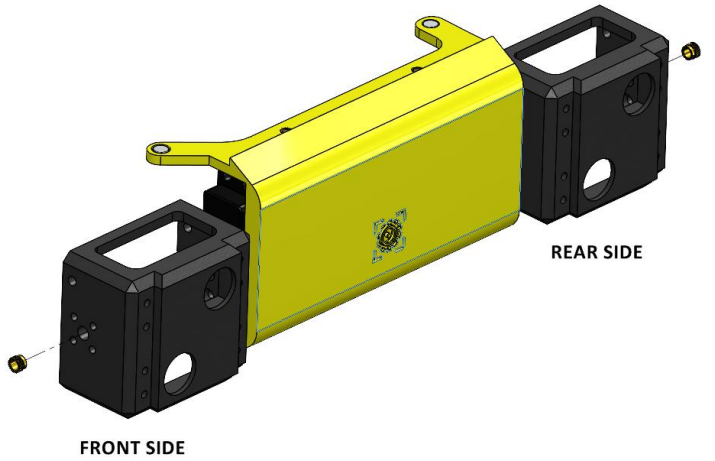
Heat Inserts

0001-0202 LeftServoHousing

We then insert M4 heat insets into the Left Servo Housing parts.
Note that the orientation matters here and we only want to insert the threat on the outside of the housing.

The side cover illustrates the orientation.



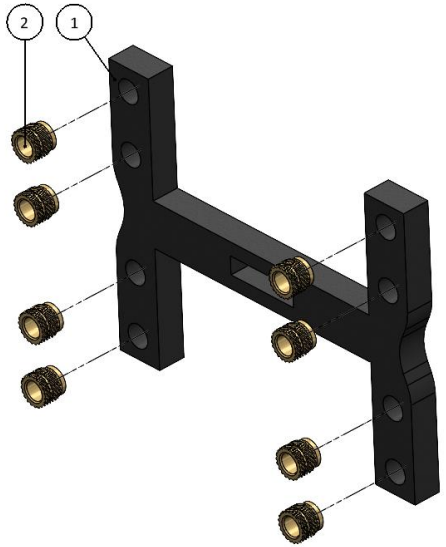


Heat Inserts

0001-0203 ServoMotor_Bracket

Installing M3 Heat Insets

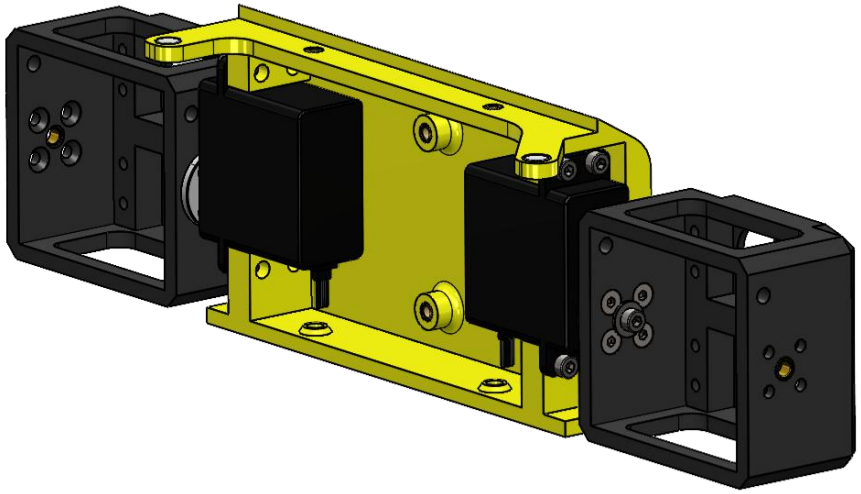
Item	Qty.	Description	Article No.
1	1	Servo Motor Bracket	0001-0203 ServoMotor_Bracket
2	8	Heat Insert	M3x5x4 Heat Insert

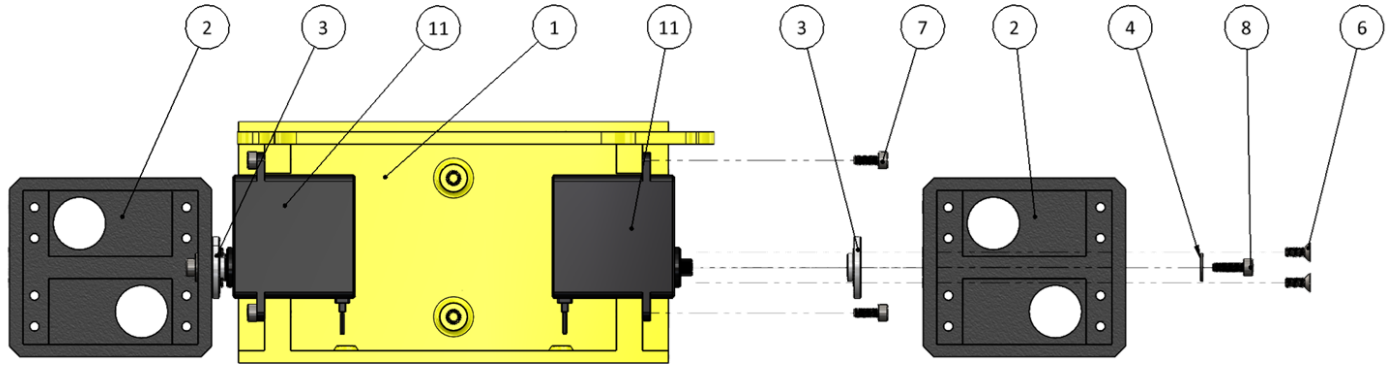


Assembly

0001-0200 LeftSide_Complete

Let's start putting the left side together.
We start with the hip servo's and the servo housing.



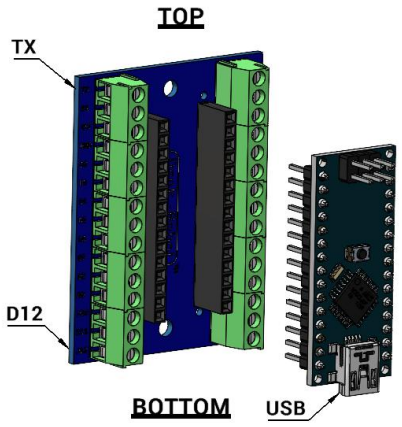


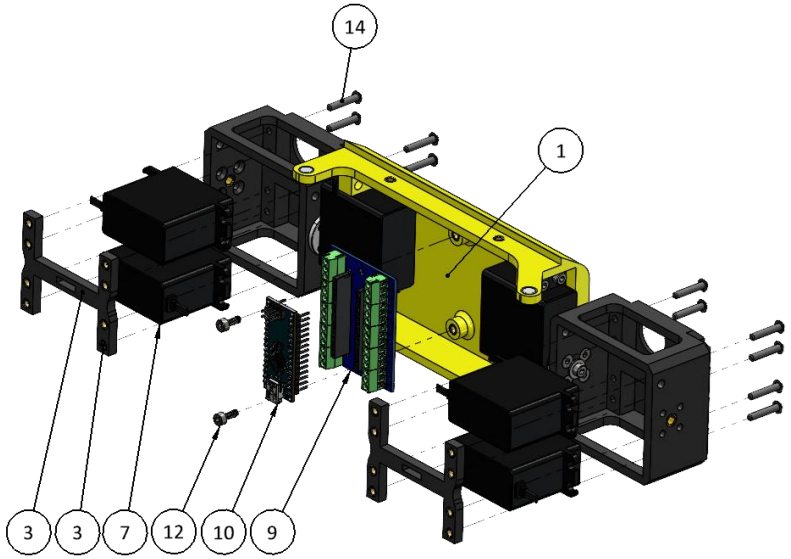
Assembly

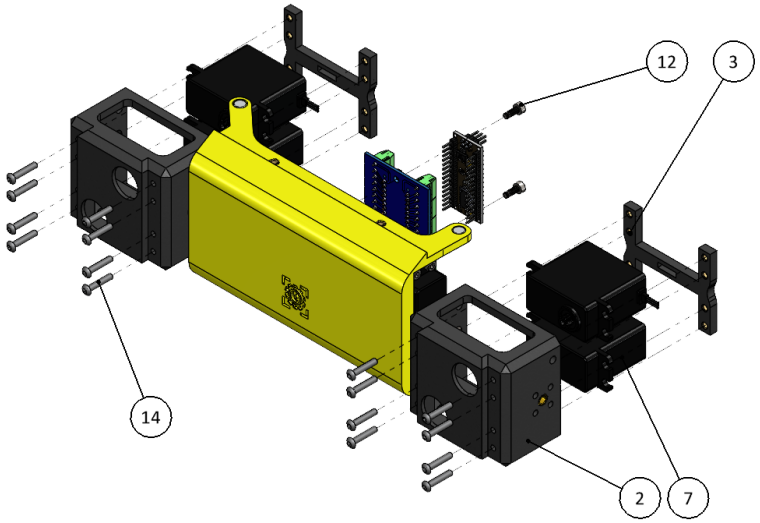
0001-0200 LeftSide_Complete

We continue assembling the servos into the housings.
The servo brackets come in behind the servos and is tighten with the screws that enters from the front of the housings.

We also install the Arduino Nano and the Nano terminal shield.
Note the orientation of both the shield and the Nano







Assembly

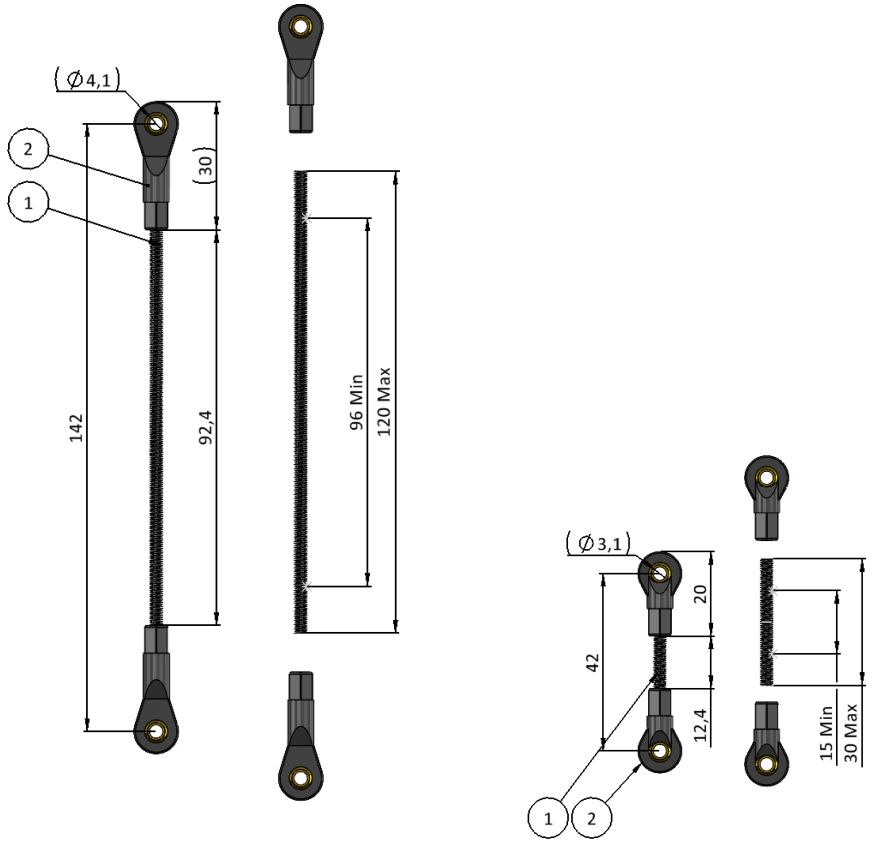
0001-0700 & 0001-0800 Link Arms

Instructions for assembling the link arms for the legs.
Generally you say you need at least three thread rotations in a fastener before you start getting diminishing returns in how strength the joint are.

M3 have 0,5mm so we need at least 1,5mm rod in the ball joint.

Short Link: Rod Length 15-30mm
Long Link: Rod Length: 96-120mm

Use a longer rod and cut to length



0001-0700 JointLong_142mm

Item	Qty.	Description	Article No.
1	1	M3 Rod 96-120mm	M3_threaded_rod
2	2	Ball Joint 30mm	Ball_head_joint_30mm

0001-0800 JoinShort_42mm

Item	Qty.	Description	Article No.
1	1	M3 Rod 15-30mm	M3_threaded_rod
2	2	Ball Joint 20mm	Ball_head_joint_20mm

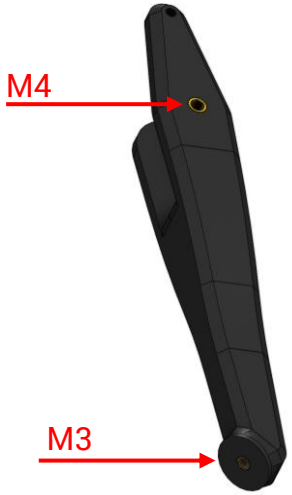
Assembly

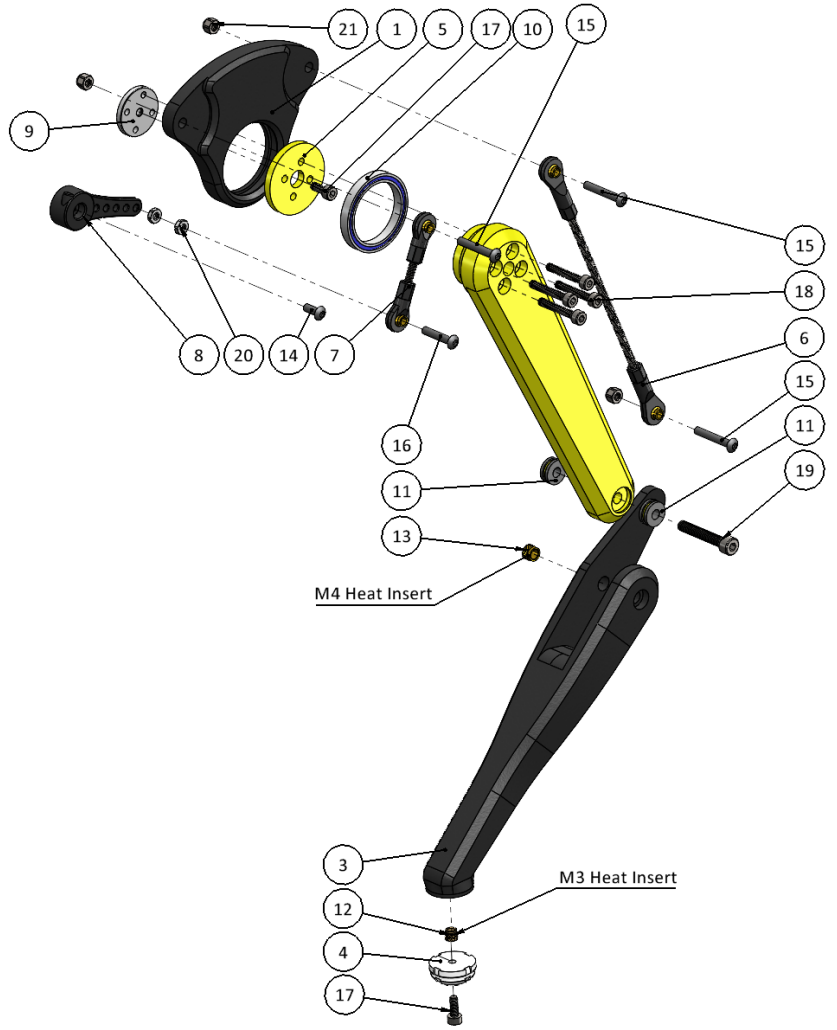
0001-0600 LeftLeg_Assembly

Instructions for assembling the Left Legs.
Note the two heat inserts that needs to be installed.

Item 14 and 17 are used to attach the legs to the main body and will tightened at later stage.

Item	Qty.	Description	Article No.
1	1	Left Servo Cam	0001-0601 LeftServoCam
2	1	Left Upper Leg	0001-0602 LeftUpperLeg
3	1	Left Lower Leg	0001-0603 LeftLowerLeg
4	1	Foot	0001-0404 Foot
5	1	Washer	0001-0405 ServoWasher
6	1	Join Assembly Long	0001-0700 JointLong_142mm
7	1	Joint Assembly Short	0001-0800 JointShort_42mm
8	1	Servo Horn	25T Servohorn
9	1	Servo Disc	Servo Disc
10	1	Bearing	6705-ZZ 25x32x4mm bearing
11	2	Axial Ball Bearing	Thust Bearing F4-10 4x10x4mm
12	1	Heat Insert	M3x5x4 Heat insert
13	1	Heat insert	m4x6x4 Heat Insert
14	1	Button Head Cap Screw	K6S - M3x8
15	3	K6S - M3x20	K6S - M3x20
16	1	Button Head Cap Screw	K6S - M3x16
17	2	Socket Head cap screw	MC6S, M3x8H
18	4	Socket Head cap screw	MC6S, M3x20H
19	1	Socket head cap screw	MC6S, M4x25H
20	2	M3 Nut - Low Profile	ML6M M3 Nut
21	3	Nylock nut	LM6M, M3



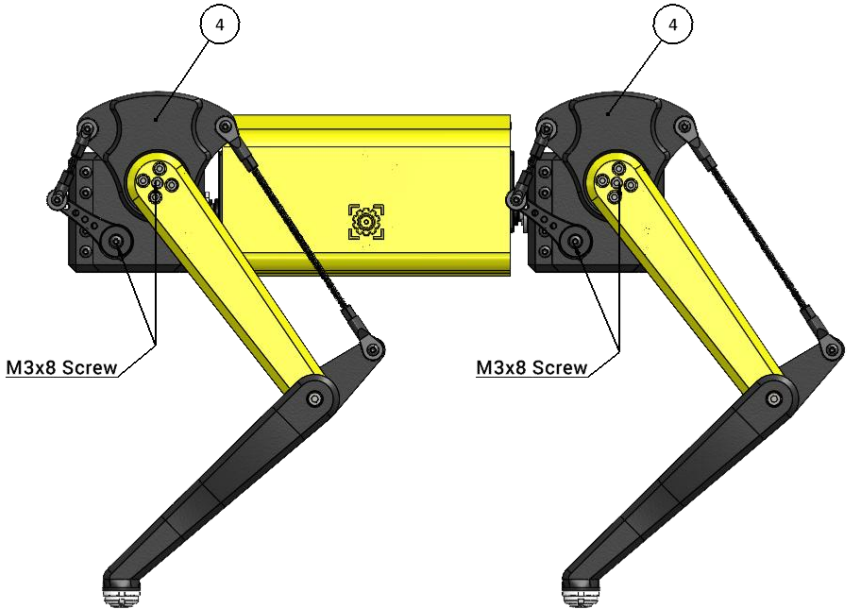


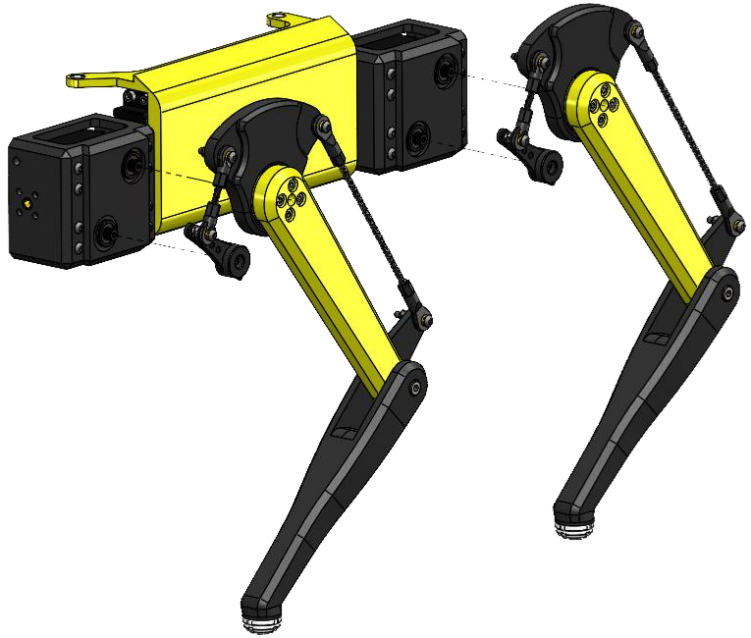
Assembly

0001-0200 LeftSide_Complete

The final step in the assembly is to install both the legs.
For Info: The M3x8 screws threading into the servo motors are apart of the Leg assembly.

Left Side is now complete





Assembly

0001-0300 RightSide_Complete

Instructions for assembling the Right Side.
Refer to the BOM when referencing the item numbers.

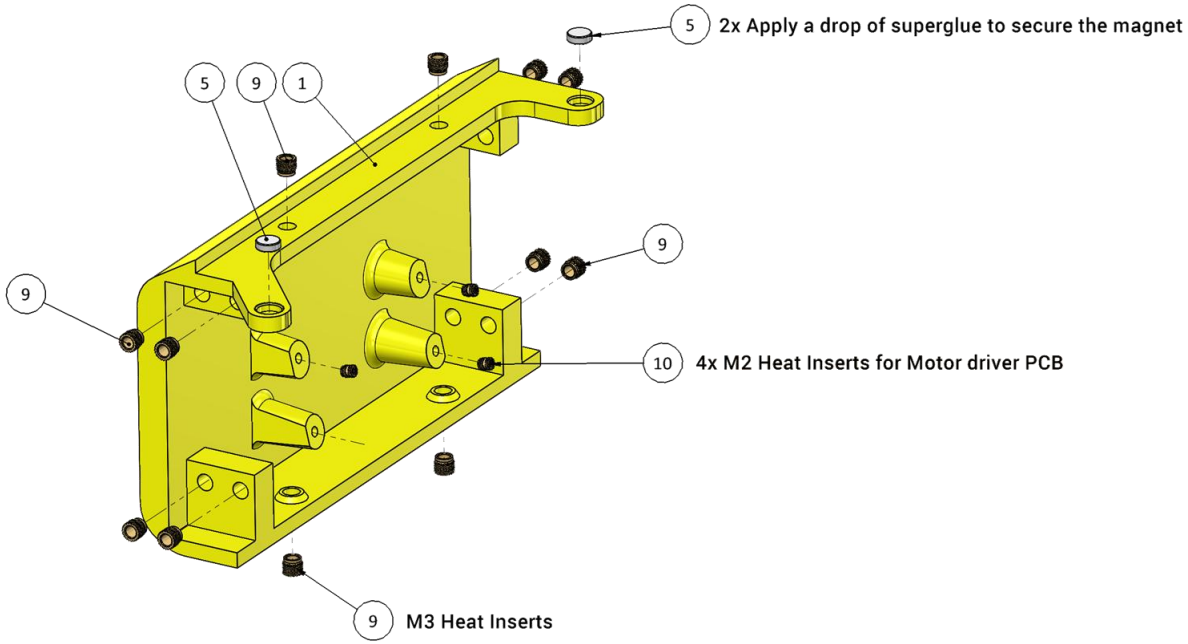
Item	Qty.	Description	Article No.
1	1	Right Side Cover	0001-0301 RightSideCover
2	2	Right Leg Assemly	0001-0400 RightLeg_Assembly
3	2	Servo Housing	0001-0302 RightServoHousing
4	2	Servo Bracket	0001-0203 ServoMotor_Bracket
5	2	Neodymium Magnet	6X2 MAGNET
6	1	Motor Driver	16_channel_PWM
7	6	Servo Motor	35kg servo
8	2	Servo Disc	Servo Disc
9	12	Heat Insert	M3x5x4 Heat insert
10	4	Heat Insert	M2x3x3mm Heat Insert
11	2	Heat insert	m4x6x4 Heat Insert
12	8	Socket Head cap screw	MC6S, M3x8H
13	2	Socket Head cap screw	MC6S, M3x10H
14	8	Countersunk head cap screw	MF6S M3x8H
15	2	Washer with large O.D	RBS, M3 (3,2x9x0,8)
16	16	Button Head Cap Screw	K6S - M3x16
17	4	Socket Head cap screw	MC6S M2x8

Heat Inserts

0001-0301 RightSideCover

Start with inserting the Heat Inserts.
The Right Side Cover needs 4pcs of M2 Heat Insert for the Motor Driver PCB .

Use some adhesive like superglue in the seatings for the magnets.

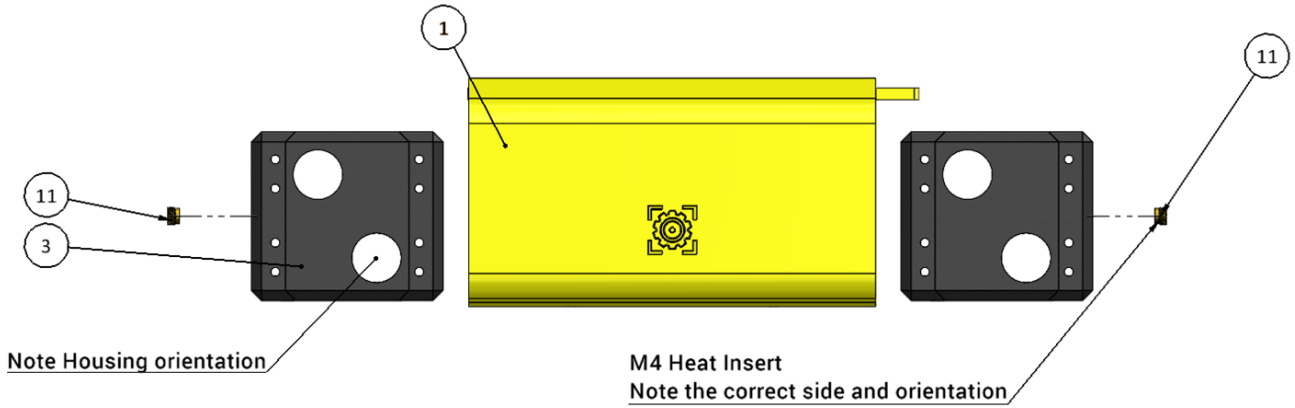


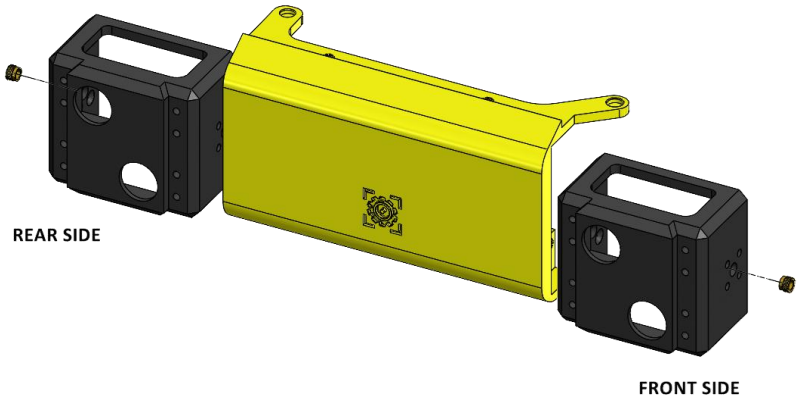
Heat Inserts

0001-0302 RightServoHousing

We then insert M4 heat insets into the Right Servo Housing parts.
Note that the orientation matters here and we only want to insert the threat on the outside of the housing.

The side cover illustrates the orientation.



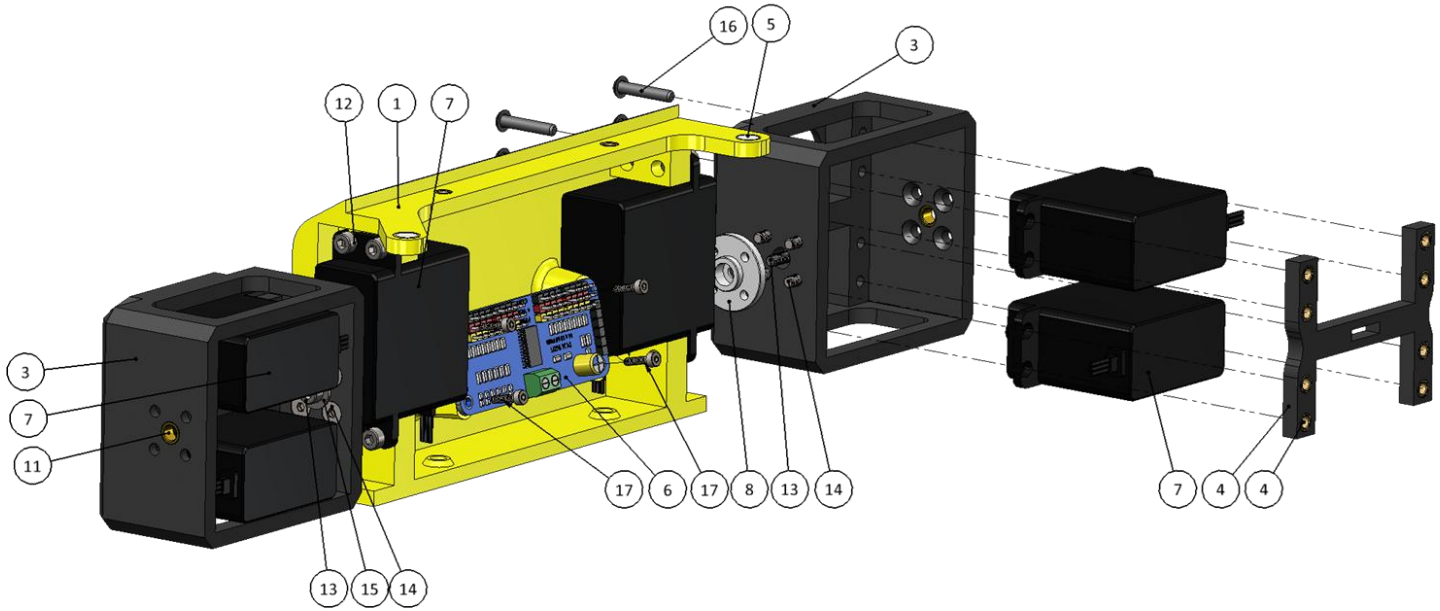


Assembly

0001-0300 RightSide_Complete

The assembly for the right side practically identical to the left side.
The difference is the side cover that functions as a bracket for the Motor Driver.

Backtrack to the Left side assembly if there is a step you need to see.
Otherwise copy that assembly.



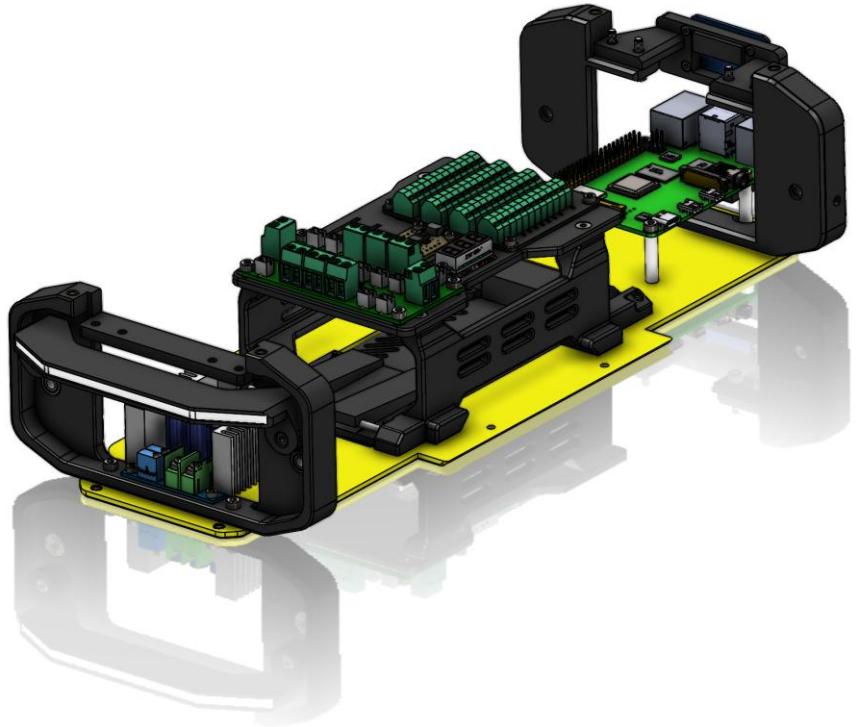
Assembly

0001-0900 Bottom_Assembly

Instructions for assembling the main body.
We start with assembling the bottom structural support and build upwards.

Refer to the BOM when referencing the item numbers.

Item	Qty.	Description	Article No.
1	1	Bottom Structural Support	0001-0901 Bottom_Structural_Support
2	1	Belly Bracket Left	0001-0902 BottomBelly_Bracket_Left
3	1	Belly Bracket Right	0001-0903 BottomBelly_Bracket_Right
4	1	Front Eyes	0001-0904 FrontEyes
5	1	Rear Structural Support	0001-0905 Rear_Structural_Support
6	1	Front Structural Support	0001-0907 Front Structural_Support
7	1	Electronics Assembly	0001-1200 Electronics_Assembly
8	4	Bearing	684zz bearing 4x9x4mm
9	1	Subassembly	0001-1100 BatteryHatch_Assembly
10	1	Buck converter	DC-DC Buck Converter CC-CV 300W 20A
11	1	Raspberry	Raspberry Pi 4 Model B
12	6	K6S - M3x10	K6S - M3x10
13	8	Socket Head cap screw	MC6S, M3x8H
14	2	Socket Head cap screw	MC6S, M3x14H
15	4	Standoff	20mm M3 Standoff
16	8	Countersunk head cap screw	MF6S M3x8H
17	4	Socket Head cap screw	MC6S M2.5x6
18	16	Heat Insert	M3x5x4 Heat insert
19	8	Heat Insert	M3x5x3 Heat insert
20	4	Heat Insert	M2.5x3x3 Heat Insert



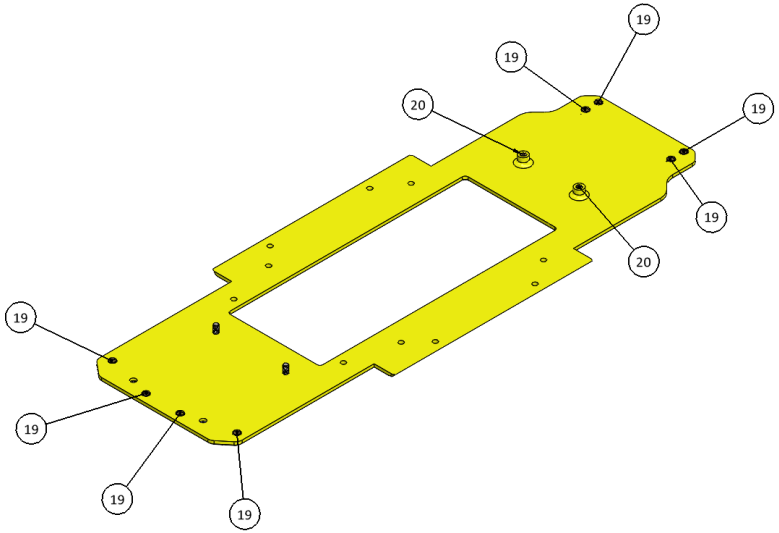
Heat Inserts

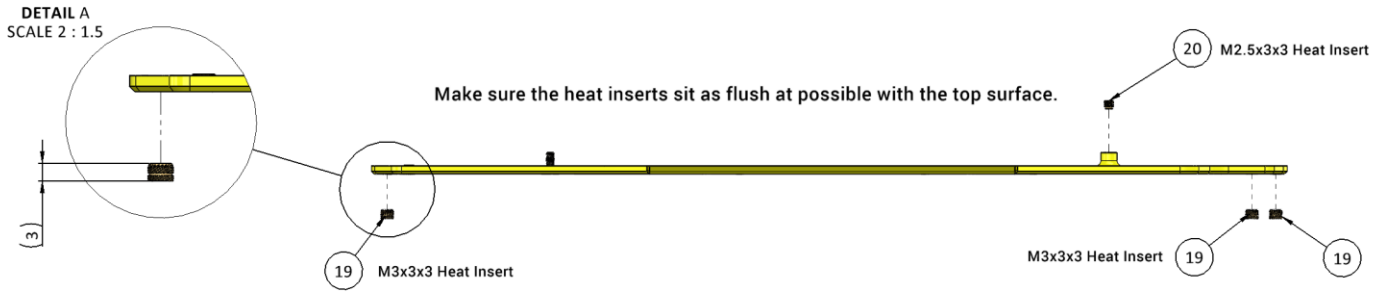
0001-0901 Bottom_Structural_Support

Use 8pcs of M3x3x3 and insert in the bottom structural support.
The part is 3mm in height so be cautious when installing the inserts and try to make them as flush as possible to the top of the support.

If you get a "bulge" you can take a scraper or knife and "shave" of the excess material around the insert.

The towers use 2pcs of M2.5x3x3 inserts for the 20A Buck converter.



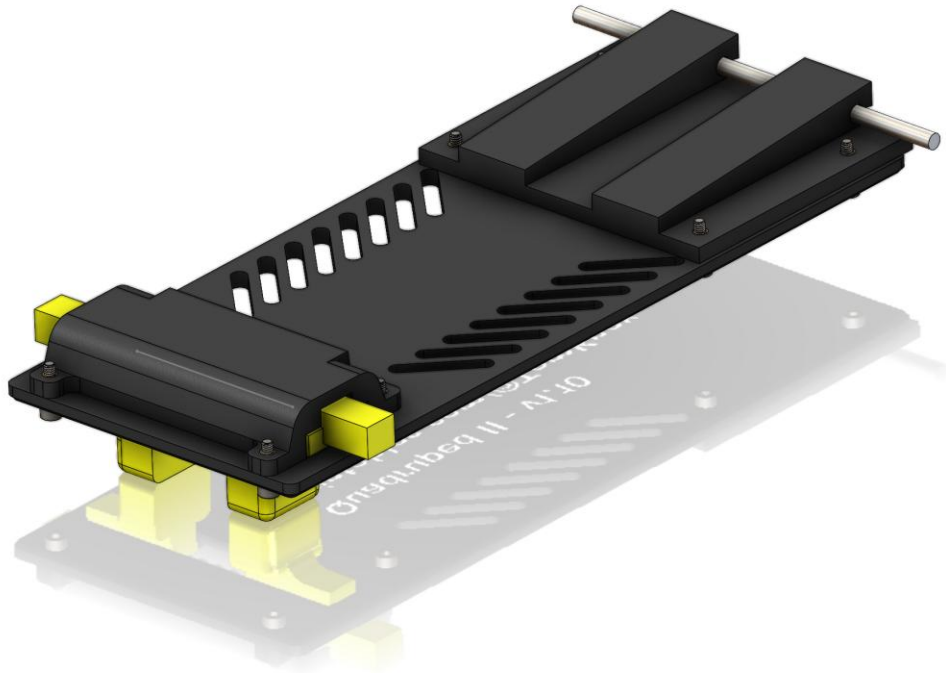


Assembly

0001-1100 BatteryHatch_Assembly

Before we go any further, we need to assemble the Battery Hatch mechanism.

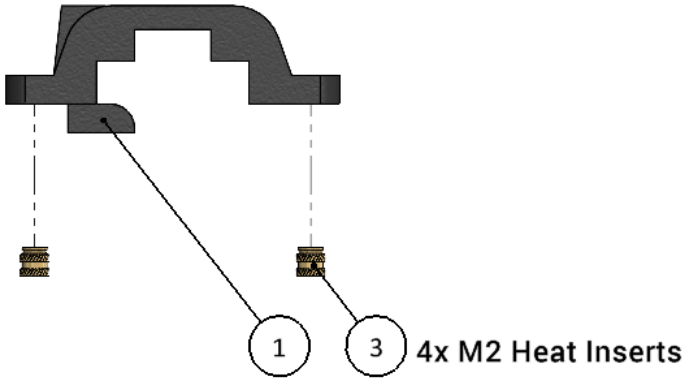
Item	Qty.	Description	Article No.
1	1	Battery Cover	0001-1101 Battery_Cover
2	2	Battery Latch	0001-1102 Battery_Latch
3	1	Battery Support	0001-1103 Battery_Support
4	1	Hinge Support	0001-1104 Battery_Hinge_Support
5	1	Compression Spring	spring_35x7mm
6	1	Smooth Rod	Battery Holder Hinge Rod 3x80mm
7	8	Socket Cap Head Screw	MC6S-M2x8
8	8	Heat Insert	M2x3x3mm Heat Insert

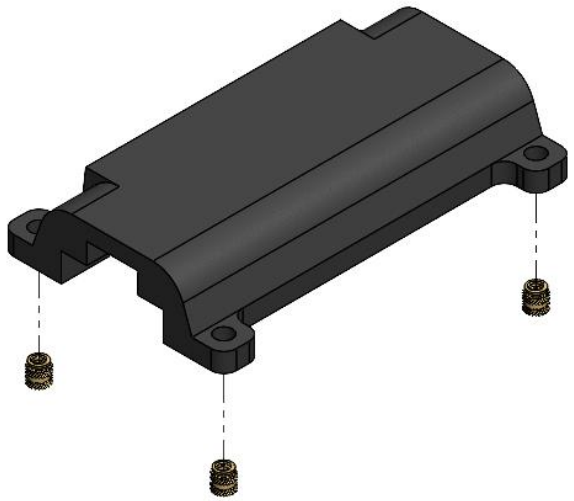


Heat Inserts

0001-1103 Battery_Support

Use 4pcs of M2x3x3 heat inserts

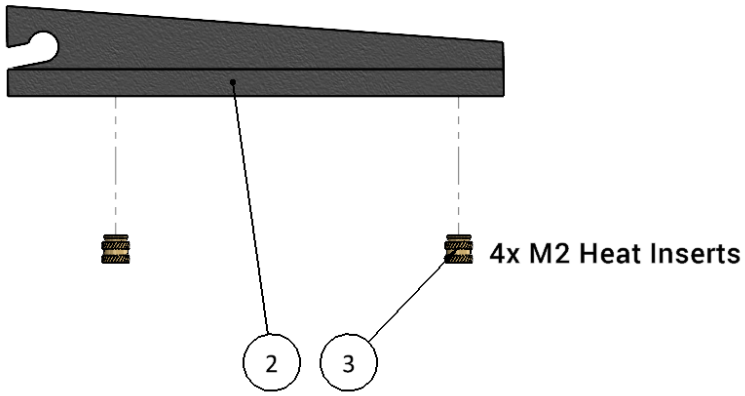


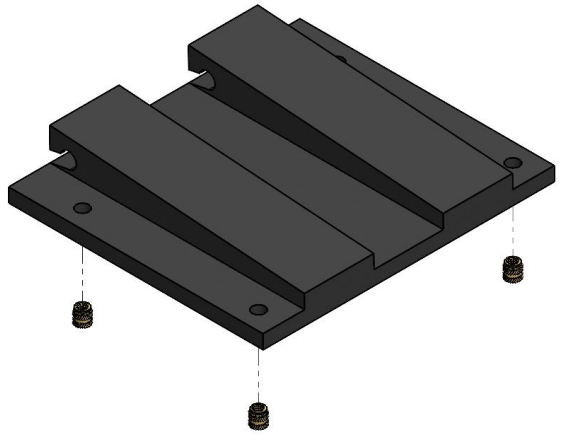


Heat Inserts

0001-1104 Battery_Hinge_Support

Use 4pcs of M2x3x3 heat inserts



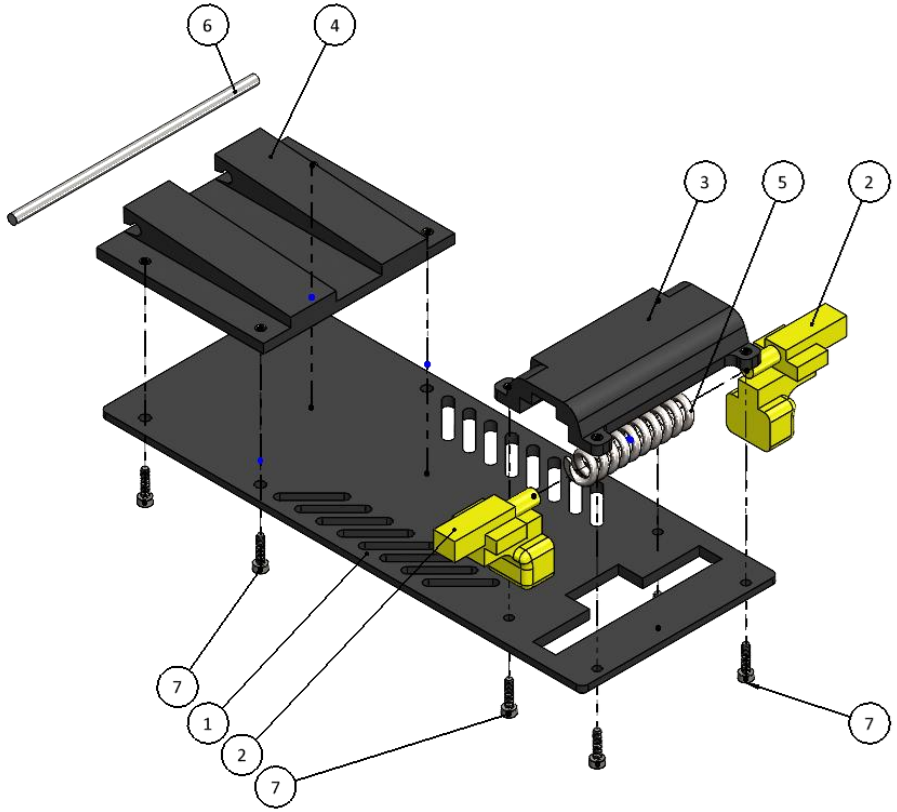


Assembly

0001-1100 BatteryHatch_Assembly

Start with putthing the spring into the cylinder of the latches.
Then push the latches with the spring through the hole and lock it in place with with the Battery support.

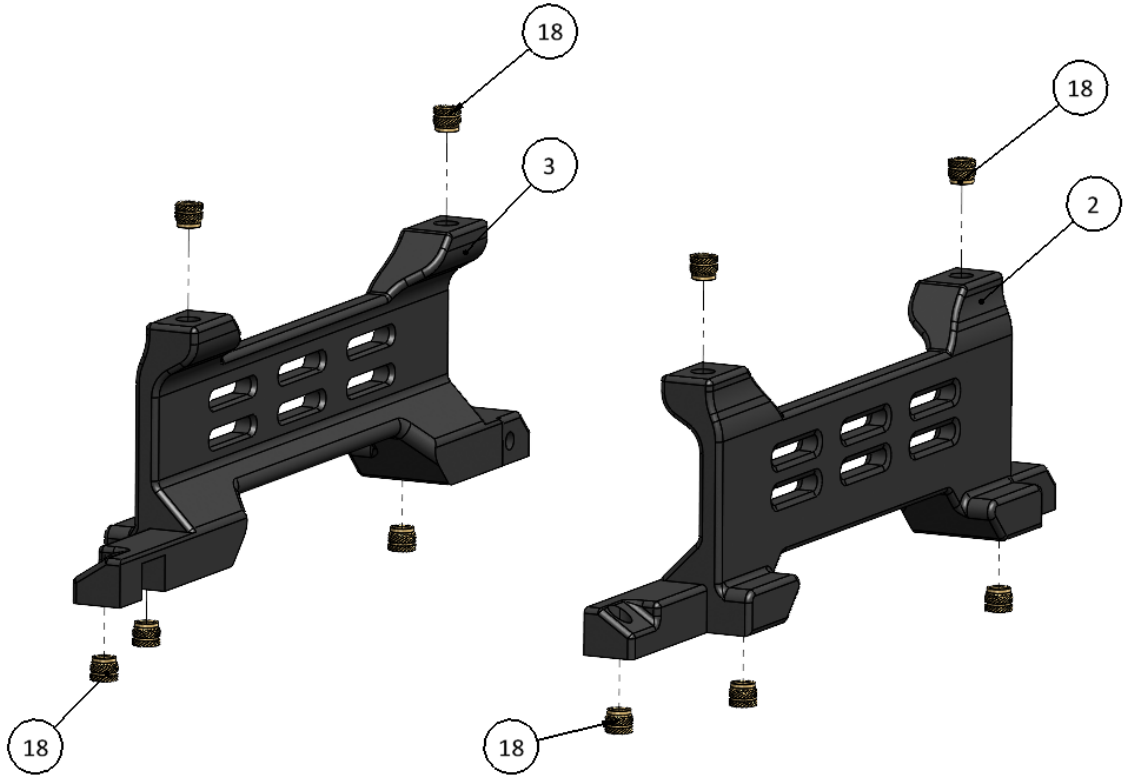
Assemble the latch mechanism and place the smooth rod in the hinge.
It will be loose right now.



Heat Inserts

0001-0902 BottomBelly_Bracket_Left
0001-0903 BottomBelly_Bracket_Right

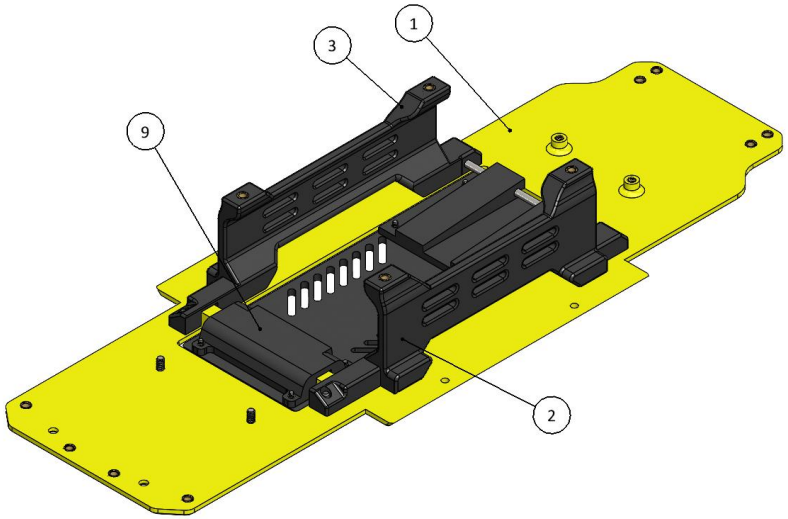
Use 10pcs of M3x5x4 heat inserts

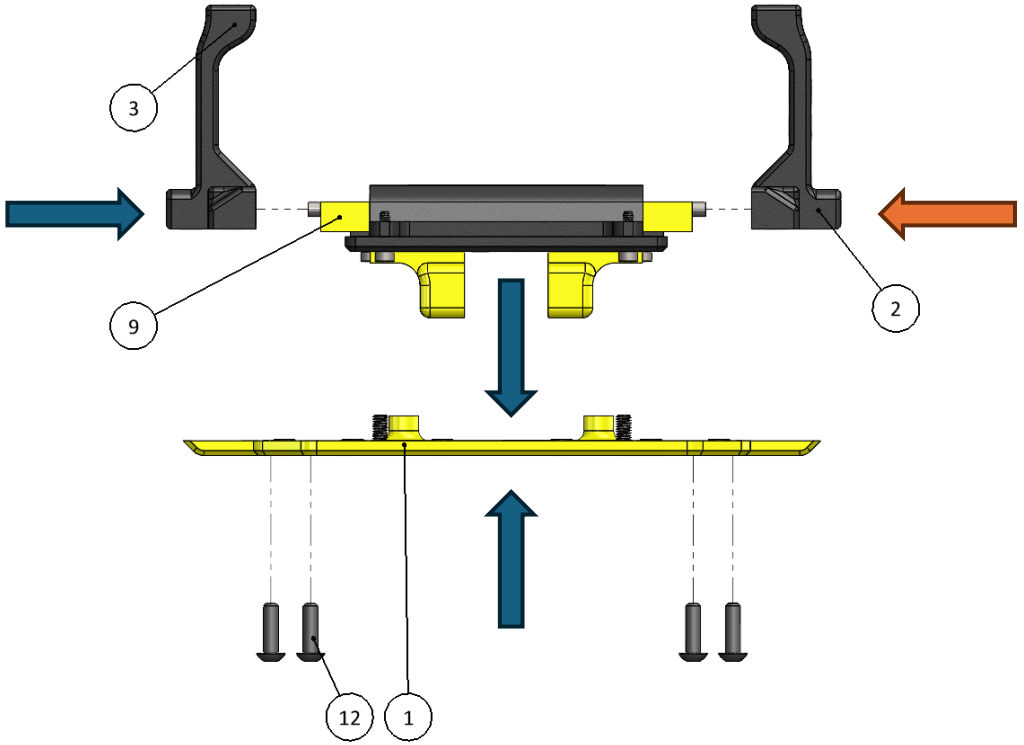


Assembly

0001-0900 Bottom_Assembly

Insert the smooth rod from the battery hatch assembly in the holes of the belly brackets and then lower the entire assembly down into the bottom structure.



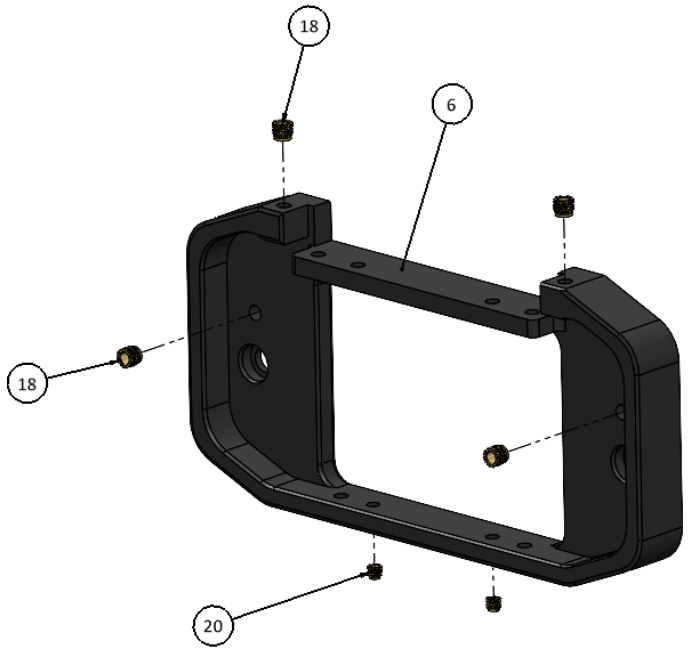


Heat Inserts

0001-0907 Front Structural_Support

Install 4pcs of M3x5x4 heat inserts

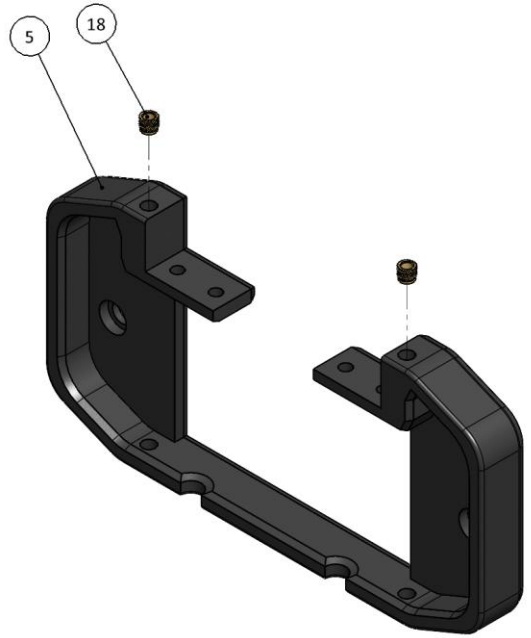
Install 2pcs M2.5x3x3 at the bottom.



Heat Inserts

0001-0907 Front Structural_Support

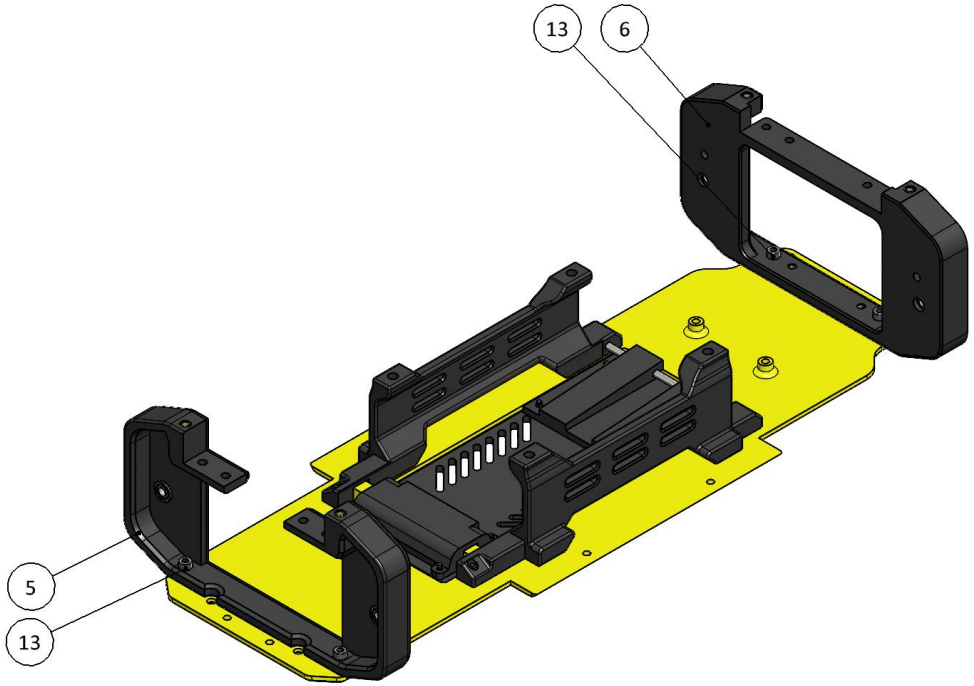
Install 2pcs of M3x5x4 heat inserts



Assembly

0001-0900 Bottom_Assembly

Assemble the Front and Rear structural supports
You'll need 4pcs MC6S M3x8 Screws

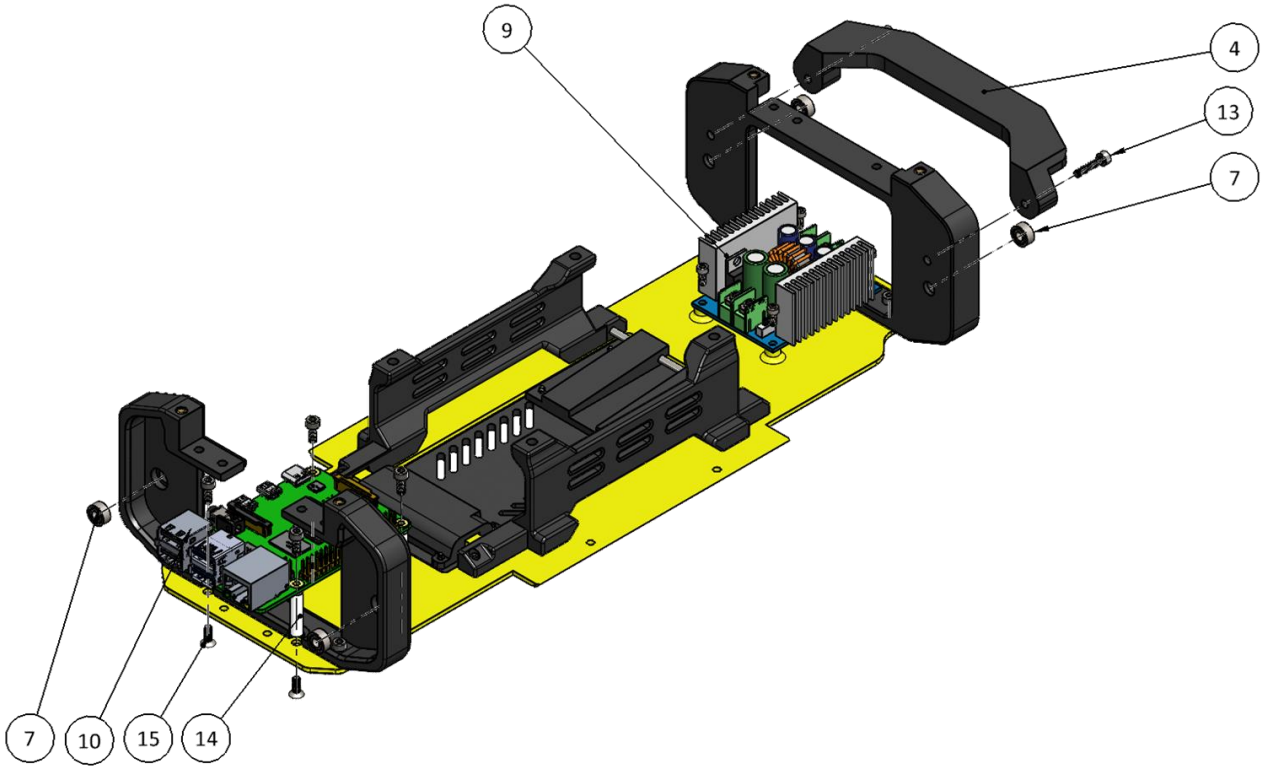


Assembly

0001-0900 Bottom_Assembly

Now we start adding some electronics.
The rasperry pi and the buck converters.

We are also adding the bearings that is the support for the legs.



Assembly

0001-0900 Bottom_Assembly

Now we start adding some electronics.
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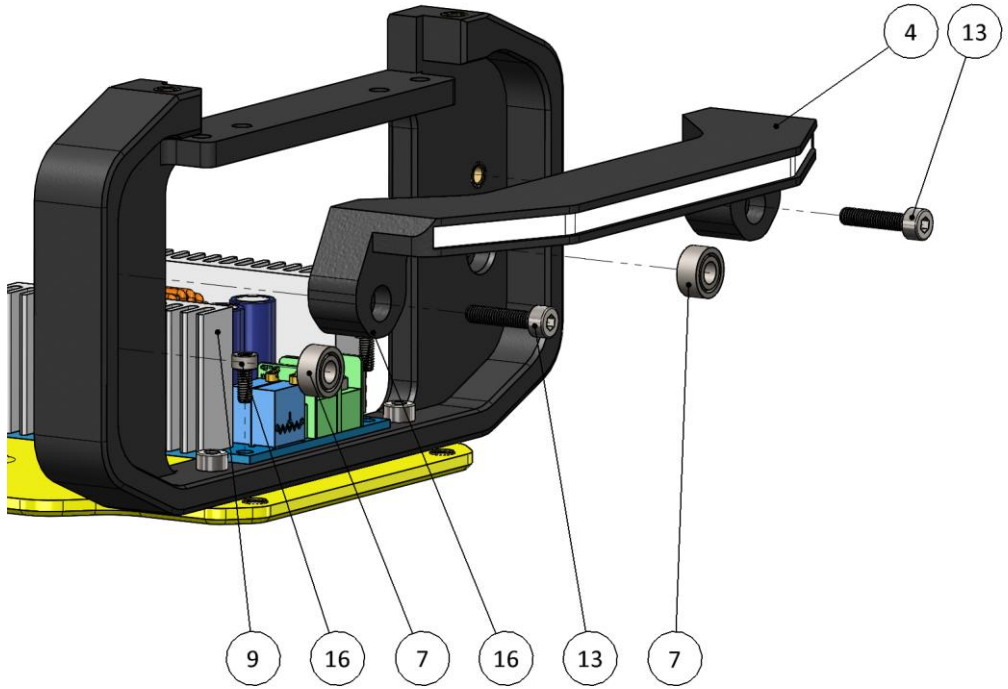
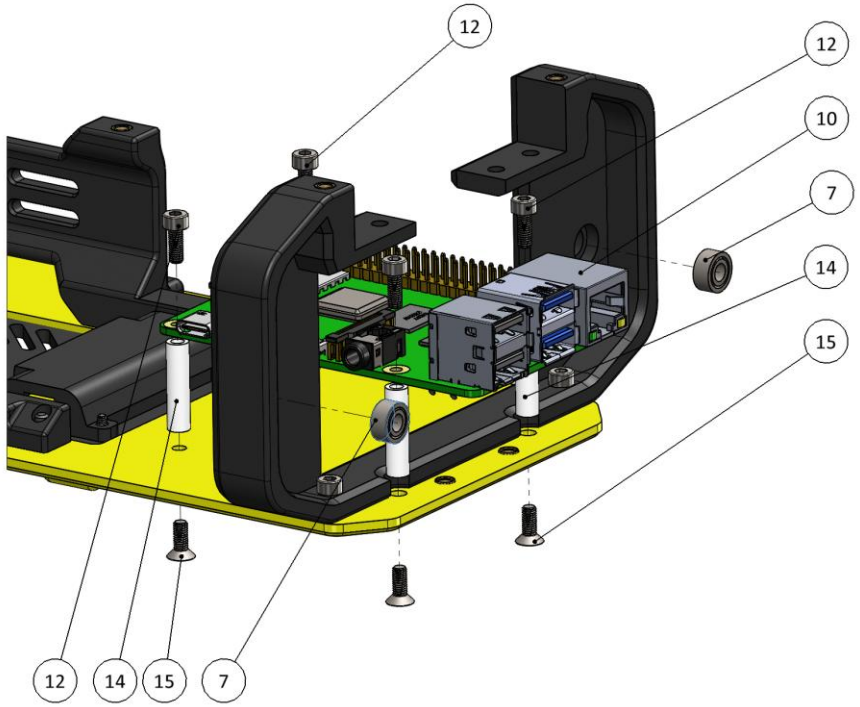


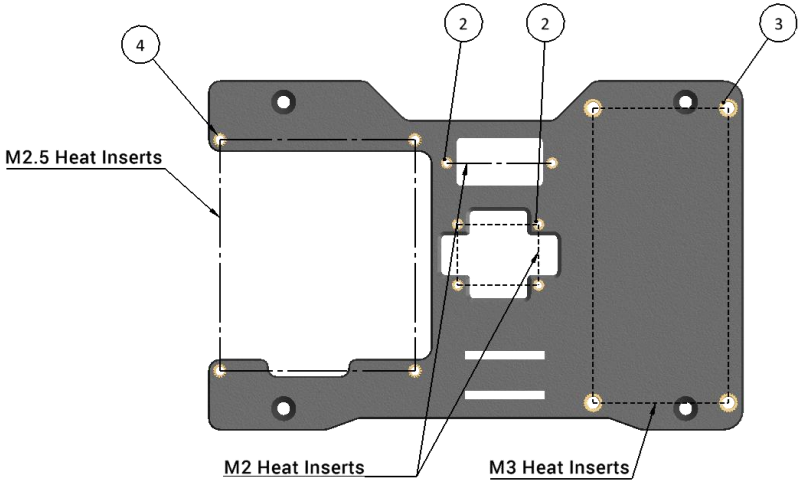


Assembly

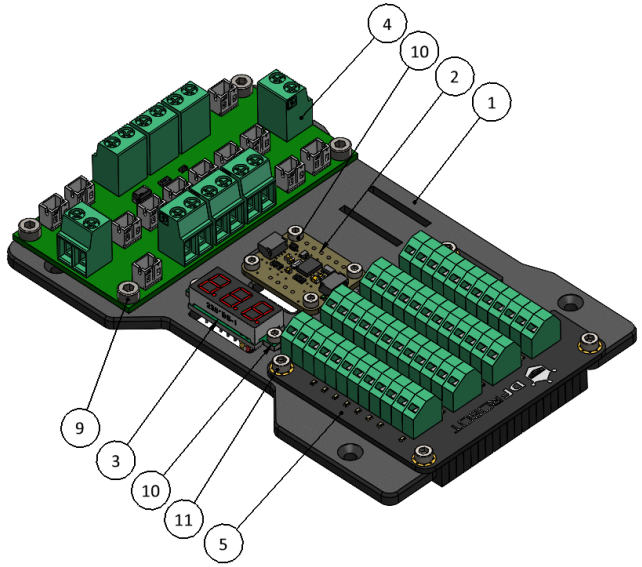
0001-1200 Electronics_Assembly

Install the Heat Inserts to the electronics bracket.
There are three different thread sizes so take note to install the correct insert at the correct position.

The mounting holes for the Electronics bracket are blocked by the electronics.
Install the bracket onto the bottom assembly before assembling the electronics.



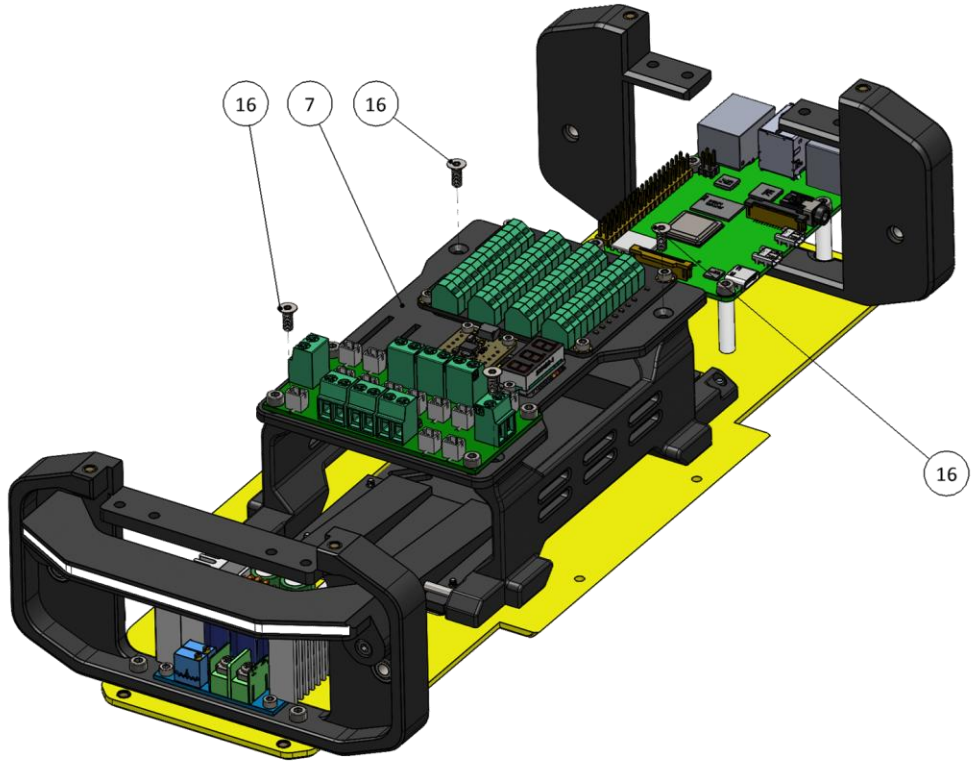
Item	Qty.	Description	Article No.
1	1	Electronics Bracket	0001-1201 Middle_Electronics_Bracket
2	1	9-DOF Absolute Orientation	IMU BNO055 Stemma
3	1	Voltmeter_Red\nA19-34-B-04	2,8_Display-3-Digi_DC 0V-100V
4	1	Power Distribution PCB	0001-1202 Power_Dist-PCB
5	1	Rhino Terminal	DFR0918
6	6	Heat Insert	M2x3x3mm Heat Insert
7	4	Heat Insert	M3x5x4 Heat insert
8	4	Heat Insert	M2.5x3x3 Heat Insert
9	4	Socket Head cap screw	MC6S, M3x8H
10	6	Socket Head cap screw	M6CS-M2x4
11	4	Socket Head cap screw	MC6S M2.5x6



Assembly

0001-0900 Bottom_Assembly

Install the electronics bracket on the bottom assembly.



Assembly

0001-0100 Quadruped_II Complete

The final steps

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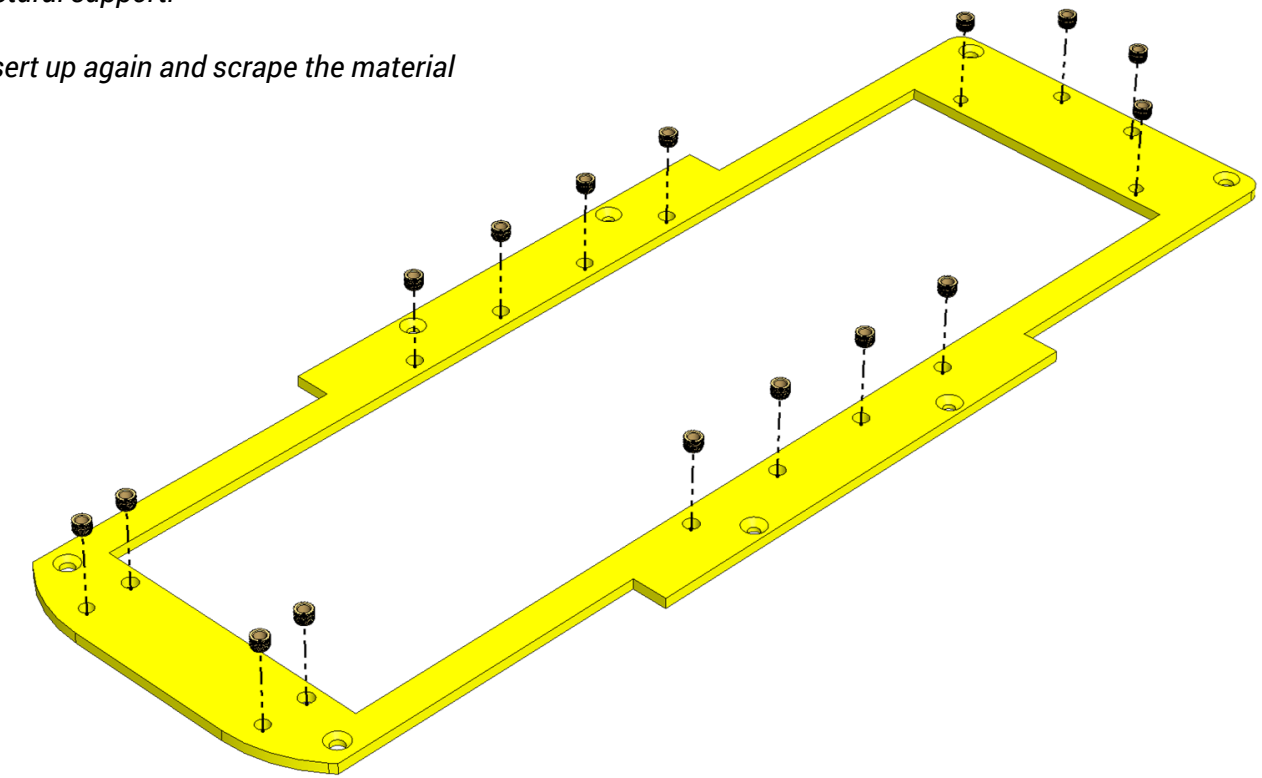
Heat Inserts

0001-0105 Top_Structural_Support

Install 4pcs of M3x5x3 heat inserts

Make sure the inserts lay flush with the top surface of the structural support.

If there are excess material creating a bump gently heat the insert up again and scrape the material off the top surface with a scraper or knife.

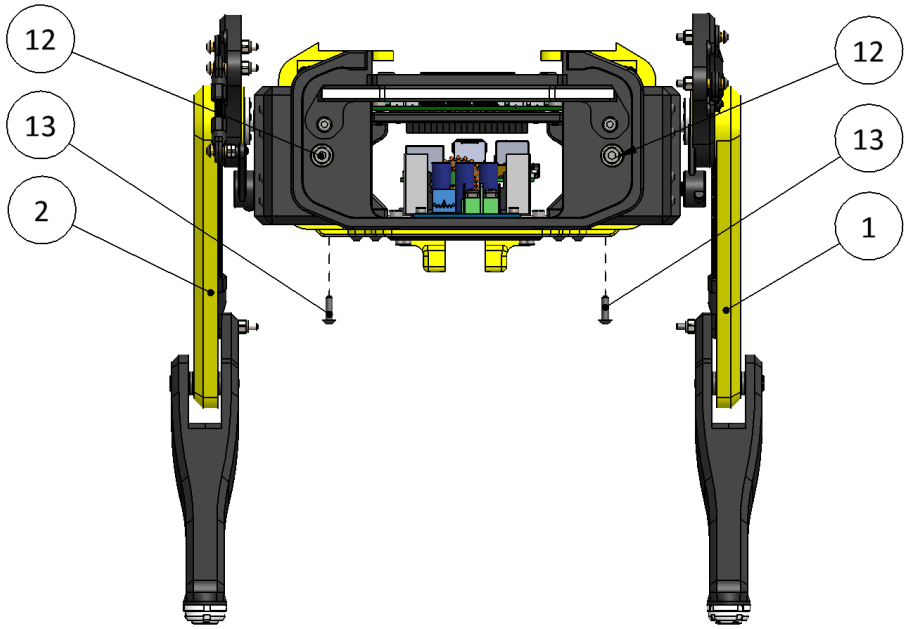


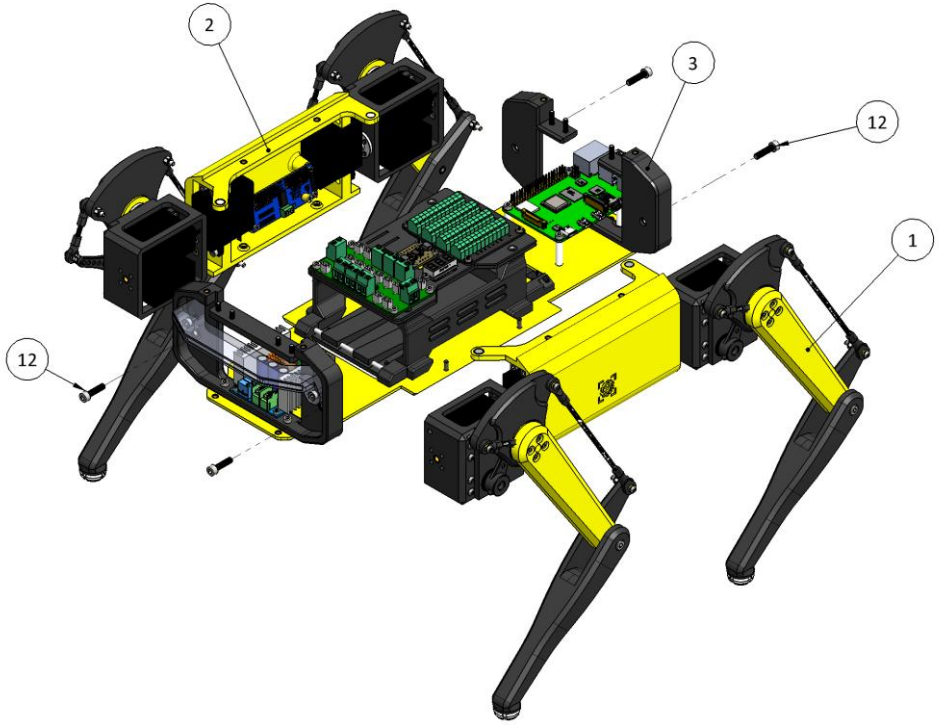
Assembly

0001-0100 Quadruped_II Complete

Let's connect the two side assemblies to the main body.

Attach the Left and Right side via the bottom support structure with 4pcs K6S M3x10 and with 4pcs of M4 MC6S M4x16 that goes through the 684zz bearing into the Servo Housing to create support for the Leg assemblies.



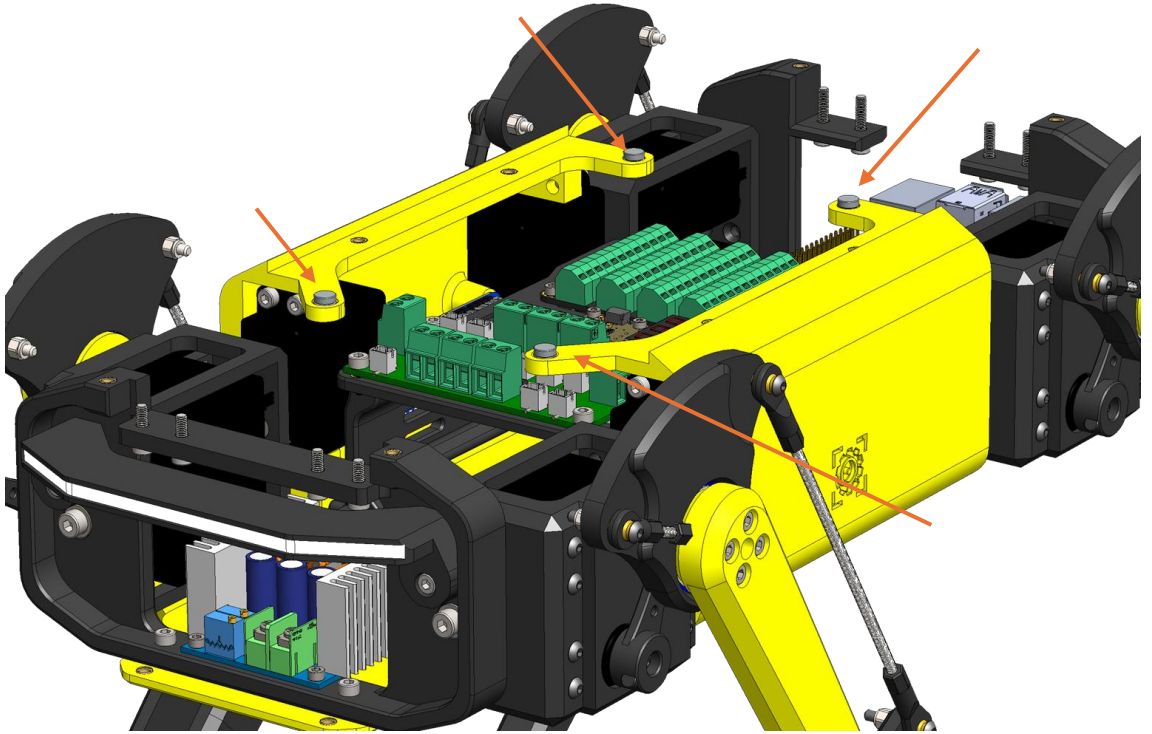


Assembly

0001-0100 Quadruped_II Complete

Get 4pcs of 6x2mm magnets and pair them to the already mounted magnets from the two sides.

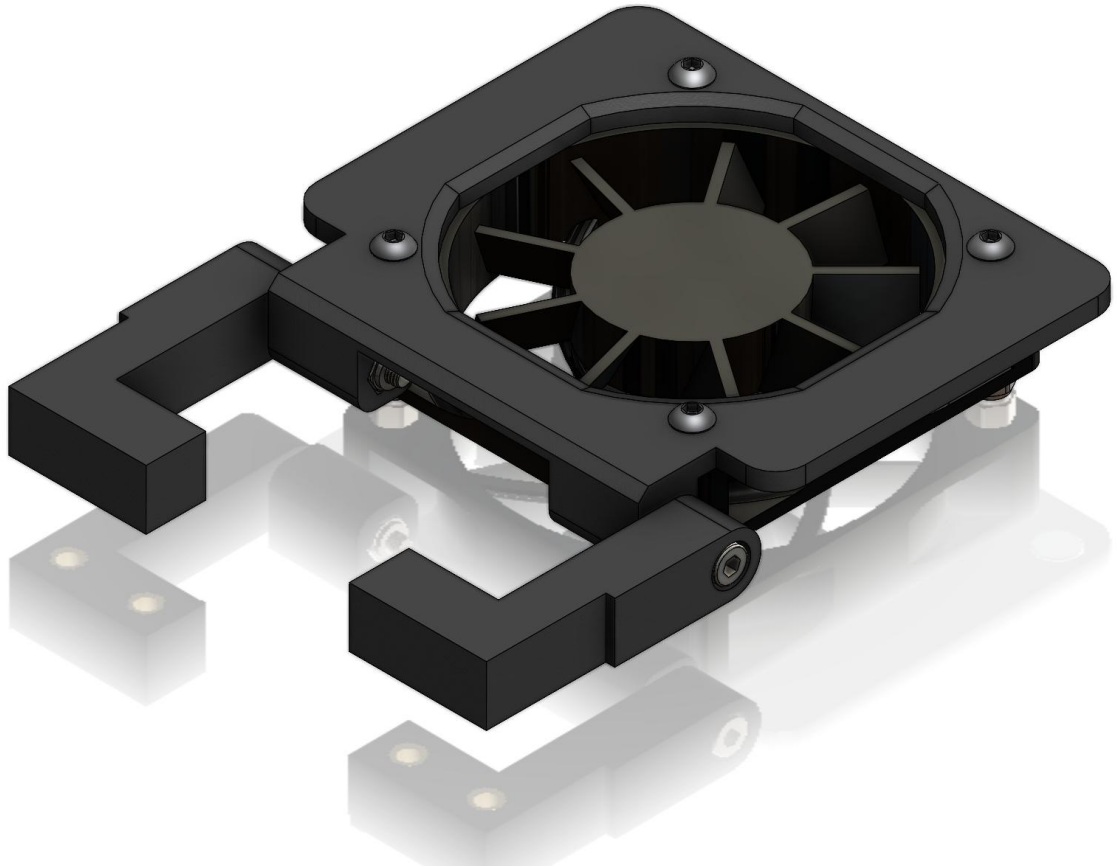
Mark the top side with a pen for example to make sure you note the polarity of the magnets.
We want them to attract each other.



Assembly

0001-1000 Fan Assembly (Rear)

Item	Qty.	Description	Article No.
1	1	Fan Housing Bracket	0001-1001 FanHousing_Bracket
2	1	Fan Left Arm (Rear)	0001-1004 Fan_RearArmLeft
3	6	Nylock nut	LM6M, M3
4	2	Socket Head cap screw	MC6S, M3x25
5	1	Fan Left Arm (Rear)	0001-1005 Fan_RearArmRight
6	1	Fan	50x50x13 12v
7	4	K6S - M3x20	K6S - M3x20
8	4	Heat Insert	M3x5x4 Heat insert
9	2	Neodymium Magnet	6X2 MAGNET



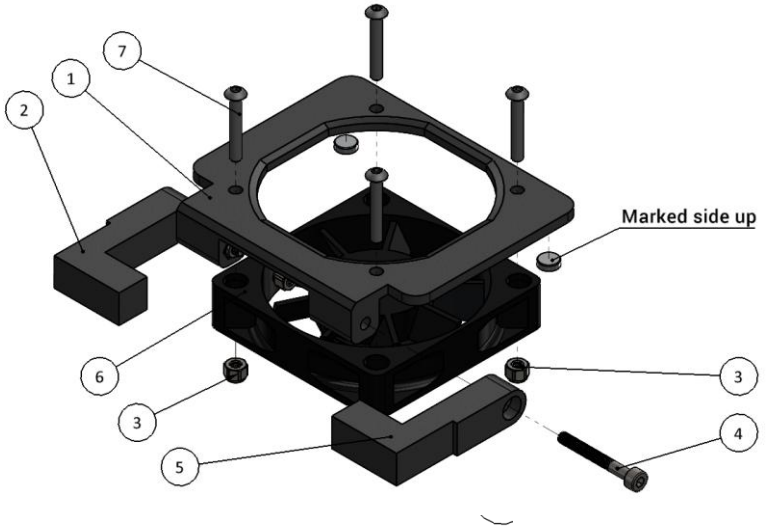
Assembly

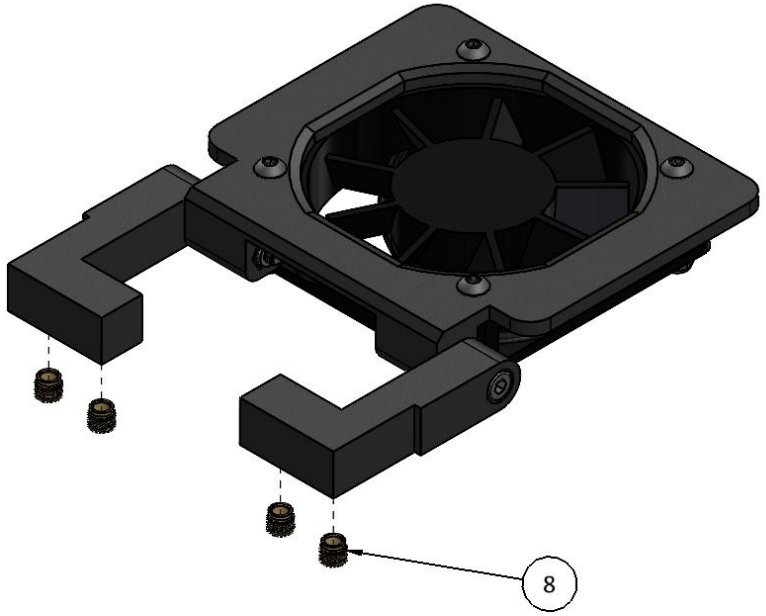
0001-1000 Fan Assembly (Rear)

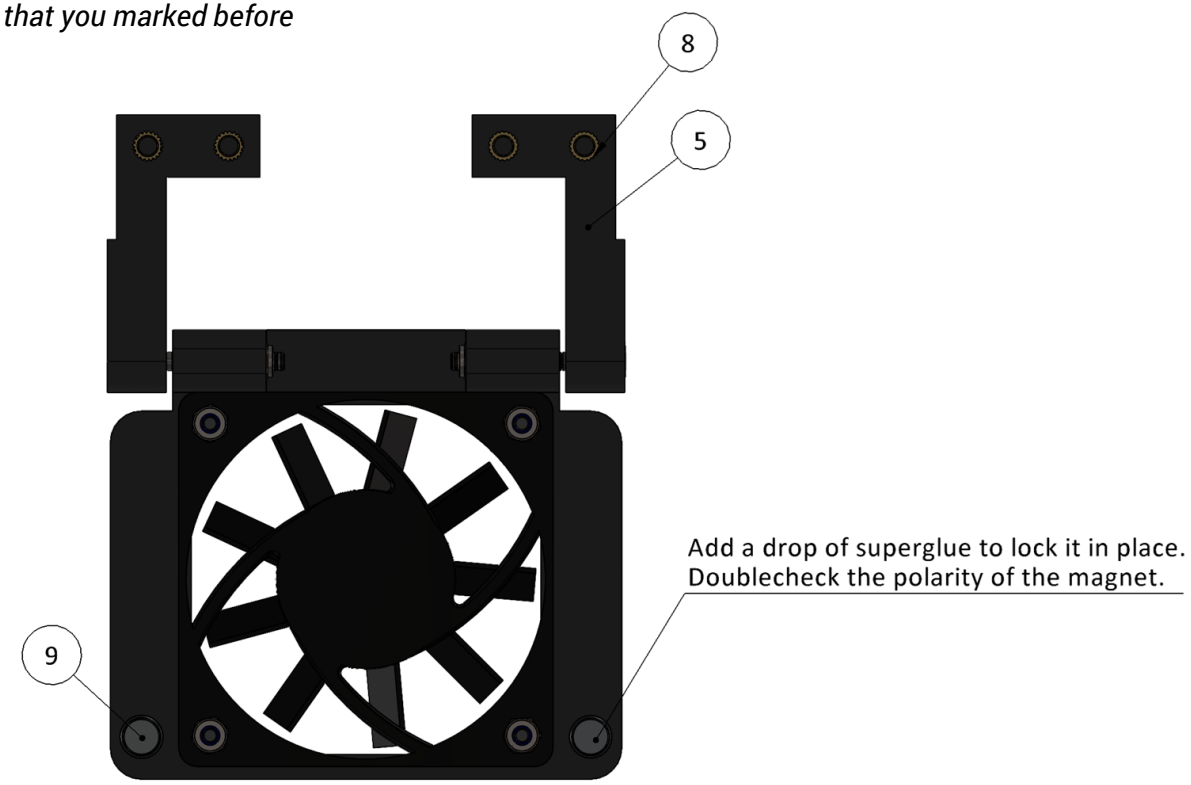
Assemble the Fan assembly.
Make sure the fan is sucking air from inside the robot. You can see the direction of the airflow illustrated with an arrow on the fan housing.

Insert 4pcs of M3 M3x5x4 Heat Inserts.

Make sure you get the correct polarity of the magnets. You want the side that you marked before to point up into the fan bracket.





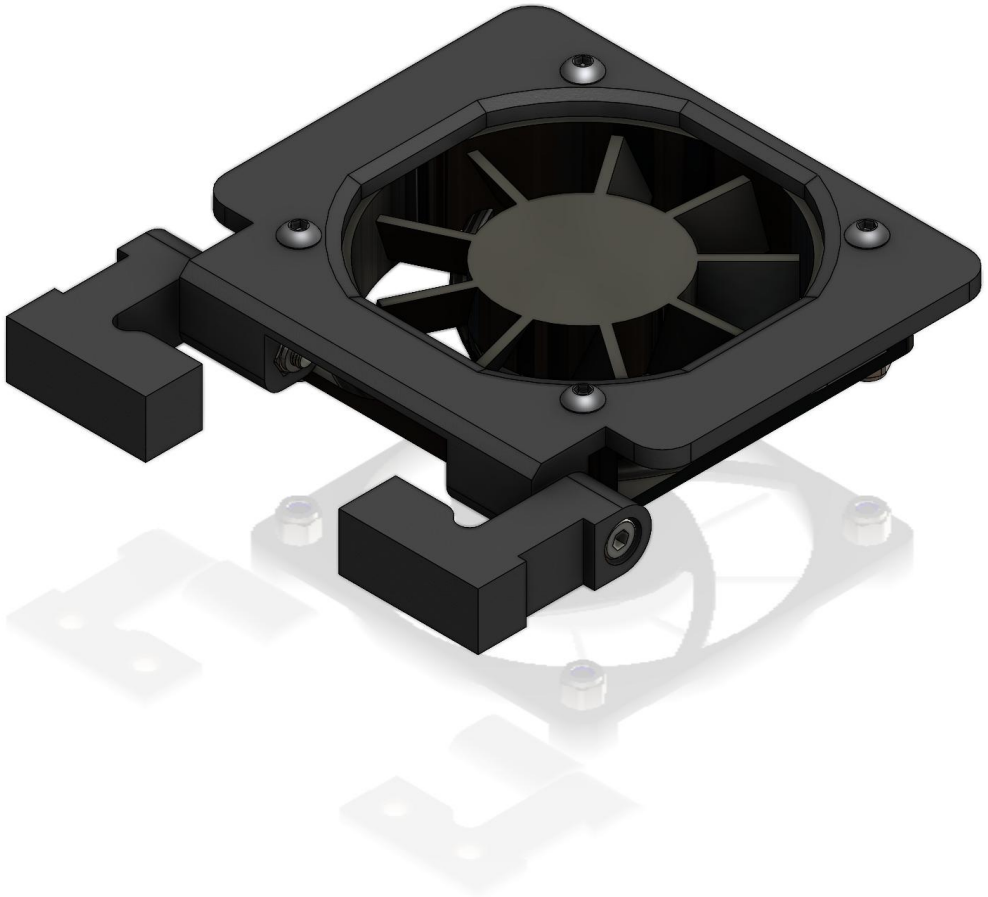


Assembly

0001-1000 Fan Assembly (Front)

Item	Qty.	Description	Article No.
1	1	Fan Housing Bracket	0001-1001 FanHousing_Bracket
2	1	Fan Left Arm (Front)	0001-1002 Fan_FrontArmLeft
3	1	Fan	50x50x13 12v
4	4	K6S - M3x20	K6S - M3x20
5	2	Socket Head cap screw	MC6S, M3x25
6	6	Nylock nut	LM6M, M3
7	4	Heat Insert	M3x5x4 Heat insert
8	2	Neodymium Magnet	6X2 MAGNET
9	1	Fan Right Arm (Front)	0001-1003 Fan_FrontArmRight

The front fan is assembled just like the rear.
The only difference is that the front fan has shorter hinge arms.



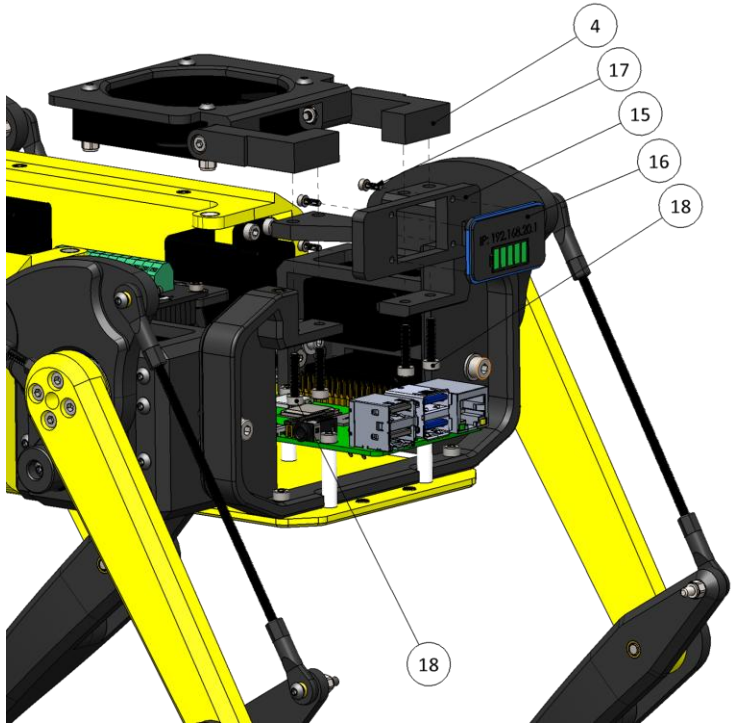
Assembly

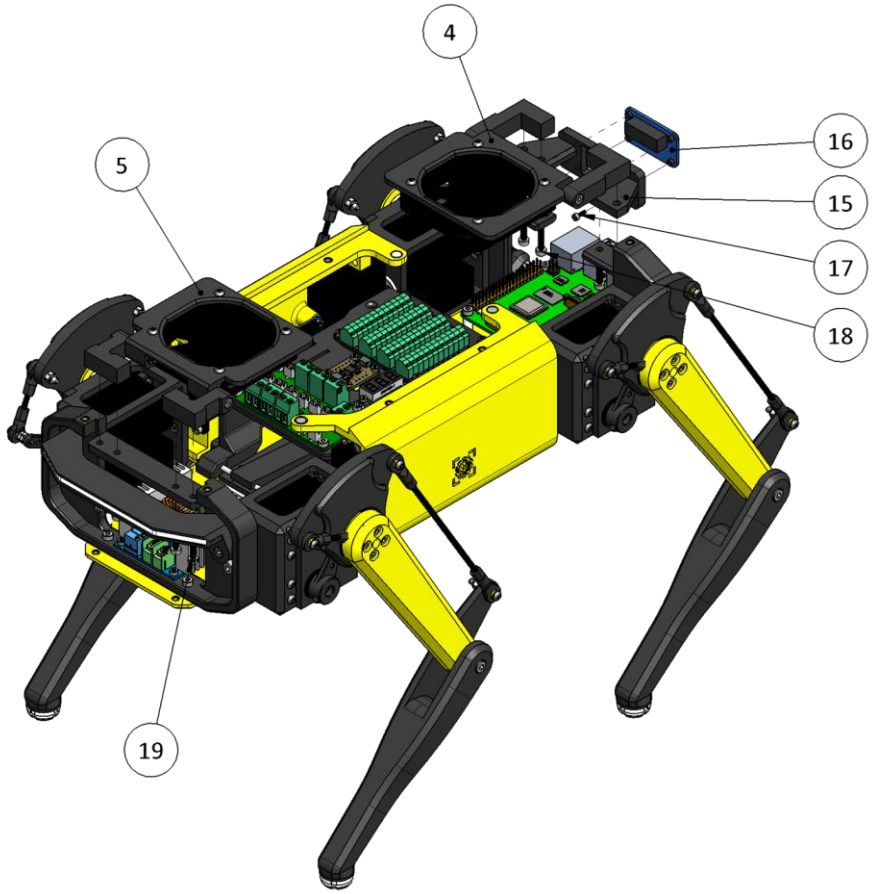
0001-0100 Quadruped_II Complete

Let's install the two fan assemblies and the LCD panel.
Start with the rear assembly. Install the LCD on the LCD bracket first with the 4pcs MC6S M2x6 screws.

You want to put the LCD bracket between the fan arms and the rear structural support and then

Thread the 4pcs M6CS M3x16 through the holes and tighten them.

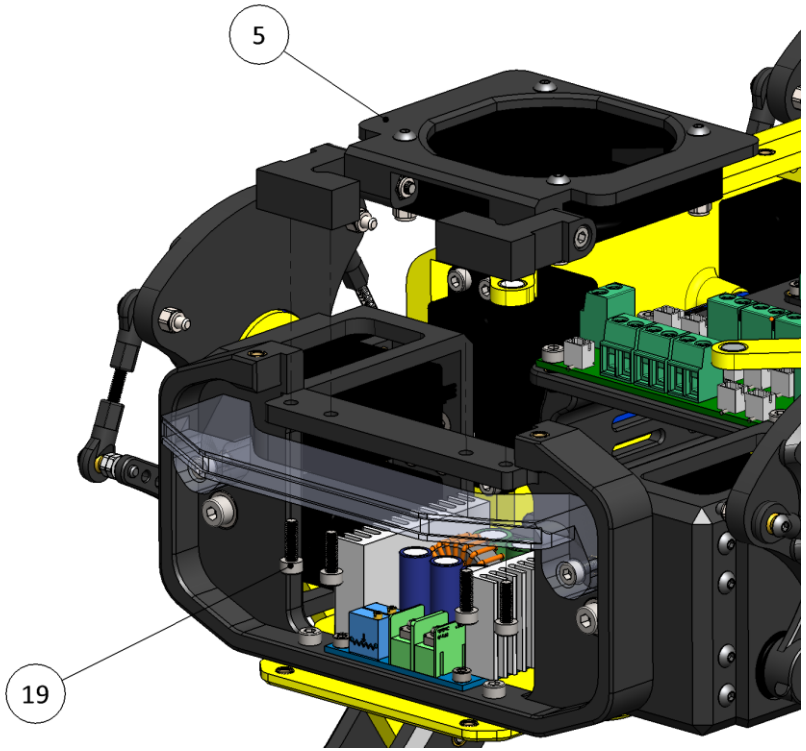


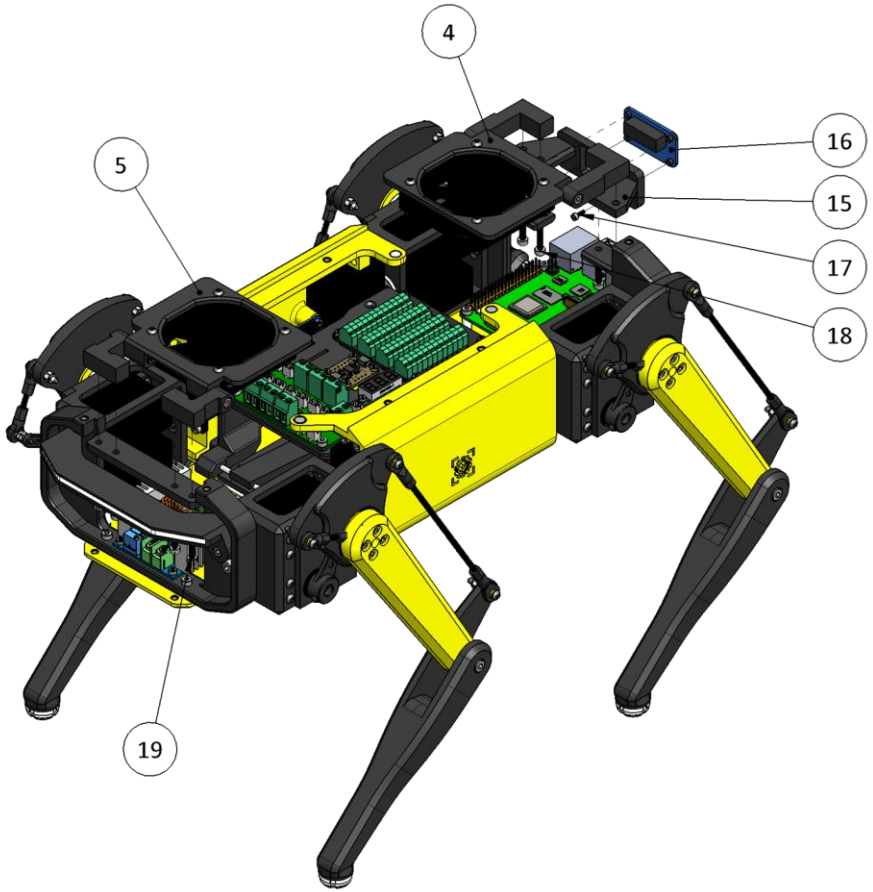


Assembly

0001-0100 Quadruped_II Complete

Move on to the front fan assembly.
Install it by using 4pcs M6CS M3x10 screws and go through the four holes on the front structural support.

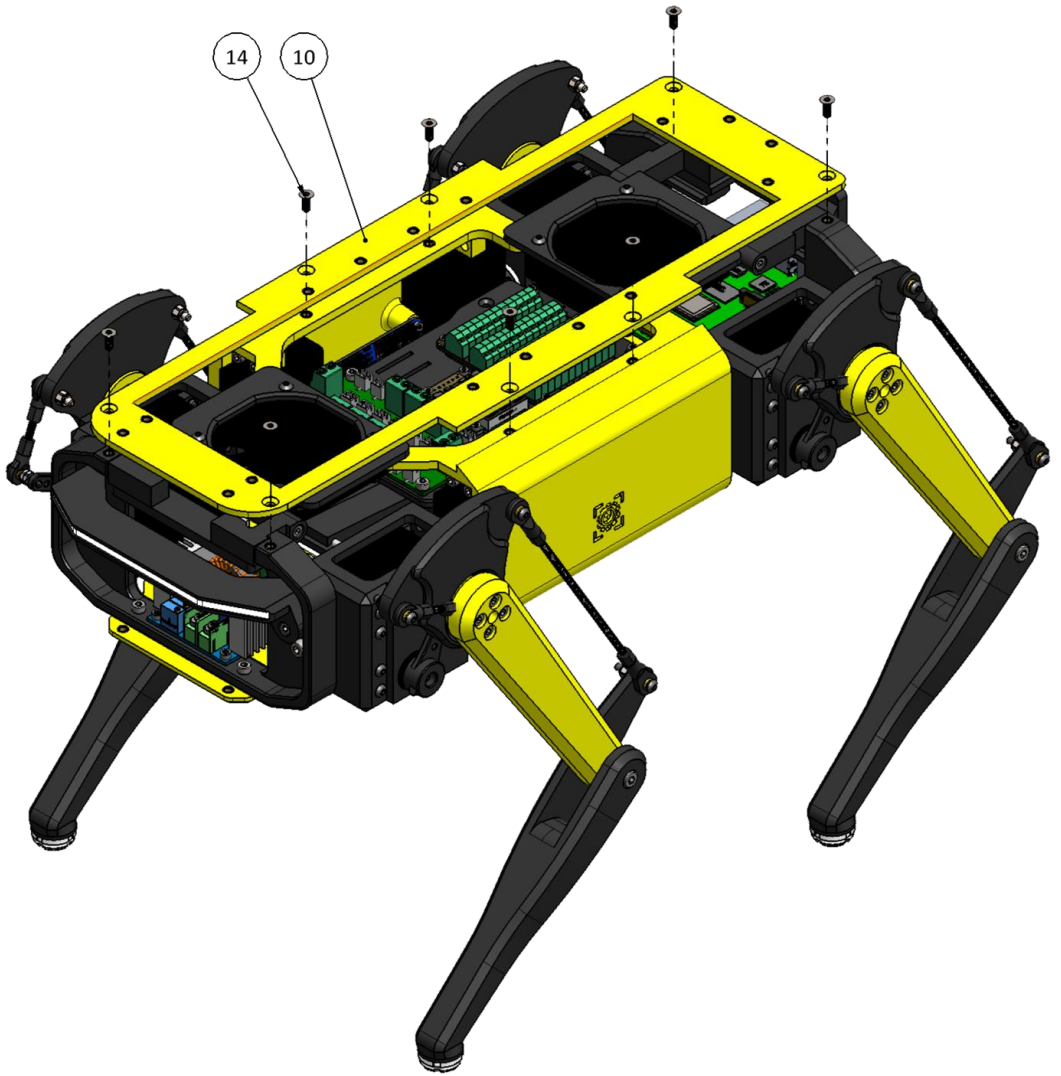




Assembly

0001-0100 Quadruped_II Complete

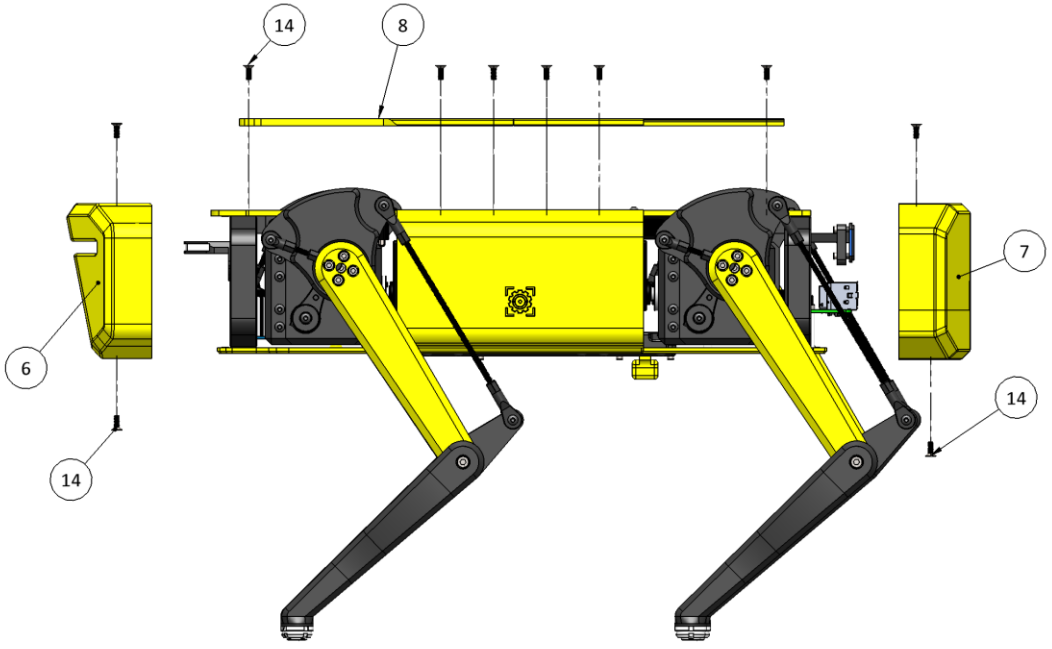
Add the Top structural support and fasten it with 8pcs of MF6S M3x8

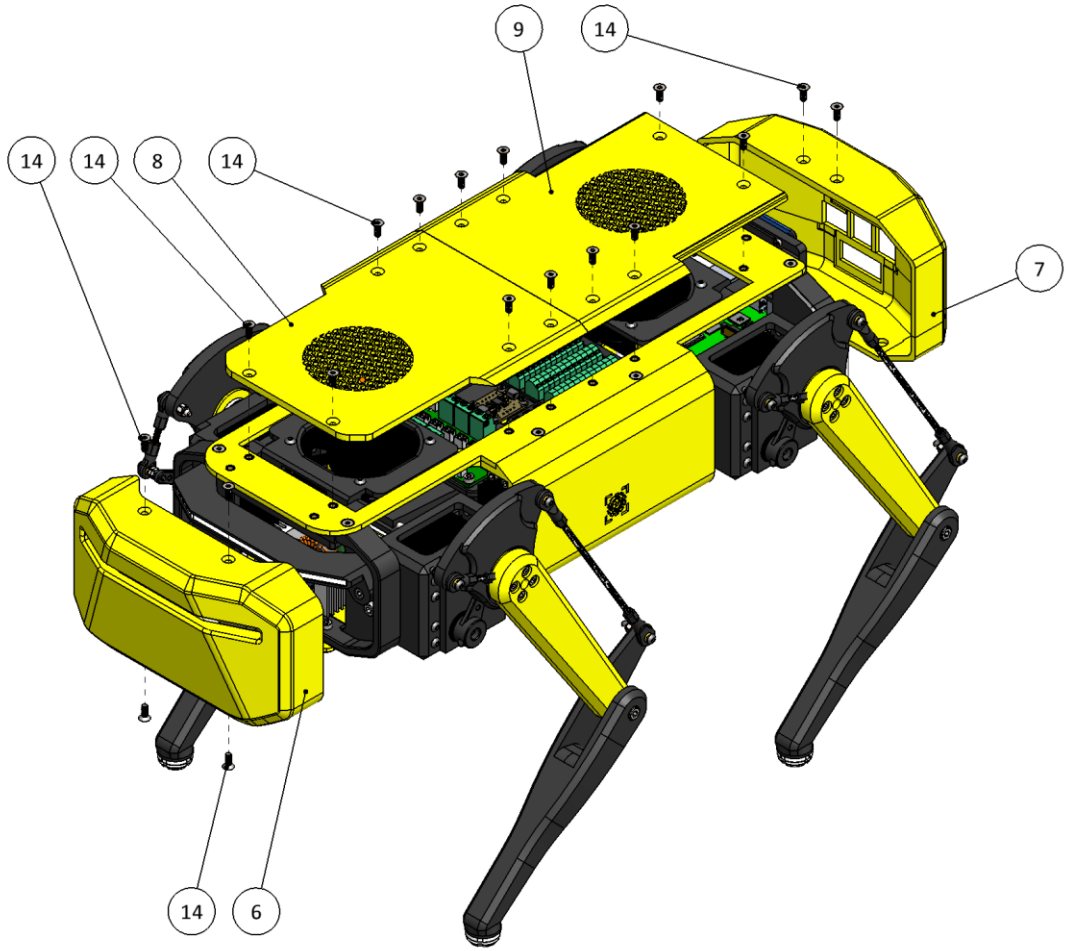


Assembly

0001-0100 Quadruped_II Complete

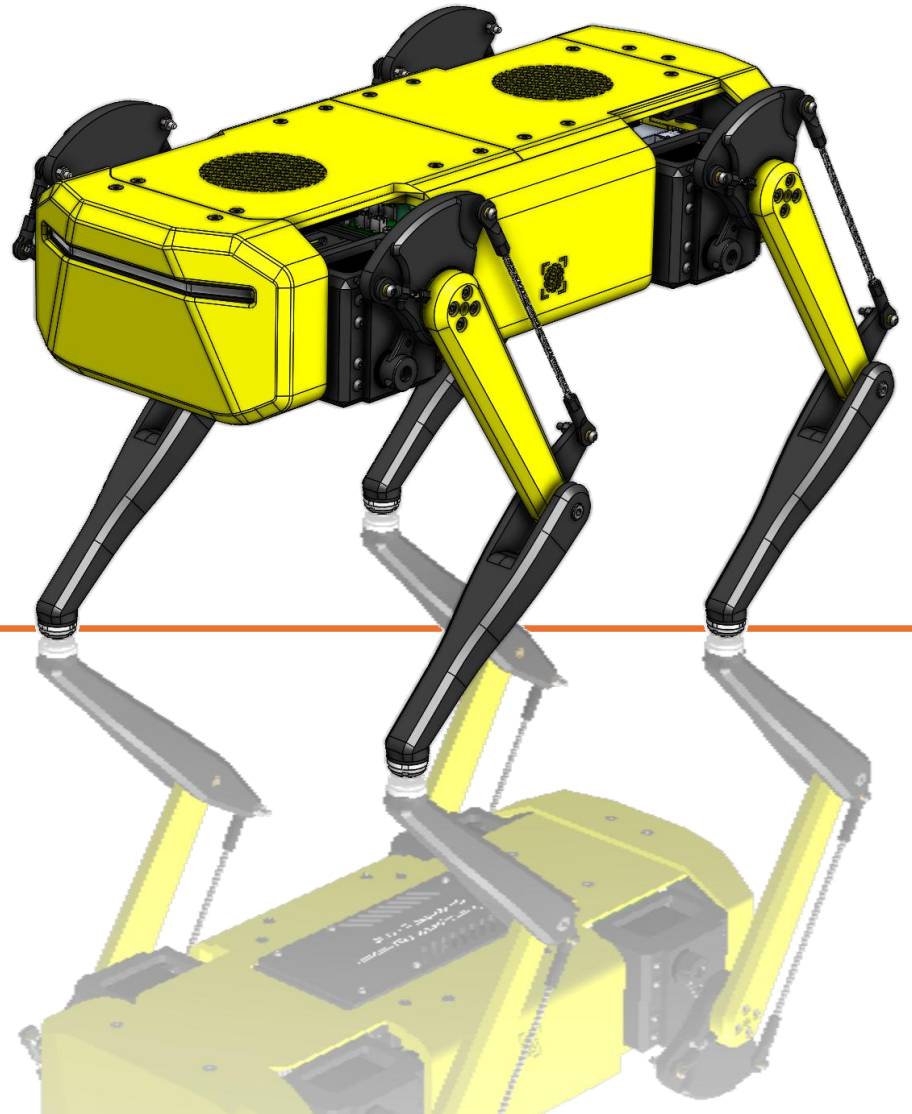
Install the cover parts with 20pcs MF6S M3x8





Quadruped II

Assembly Completed!



Quadruped v1.15