

# **DJI Phantom 3 Standard**

June 2016

by Josh Parmet



**PennEngineering<sup>®</sup>**

# DJI Phantom 3 Standard



# Details & Findings

Pictures and Description of the  
DJI Phantom 3 Standard and our  
disassembly process.

# Controller-Back Cover



- 4x 3 mm high helix screws (red)
  - Head Diameter: 0.187 in
  - Head Thickness: 0.061 in
  - Overall Length: 0.453 in
- Engage plastic bosses (purple)
- Phillips #0 driver



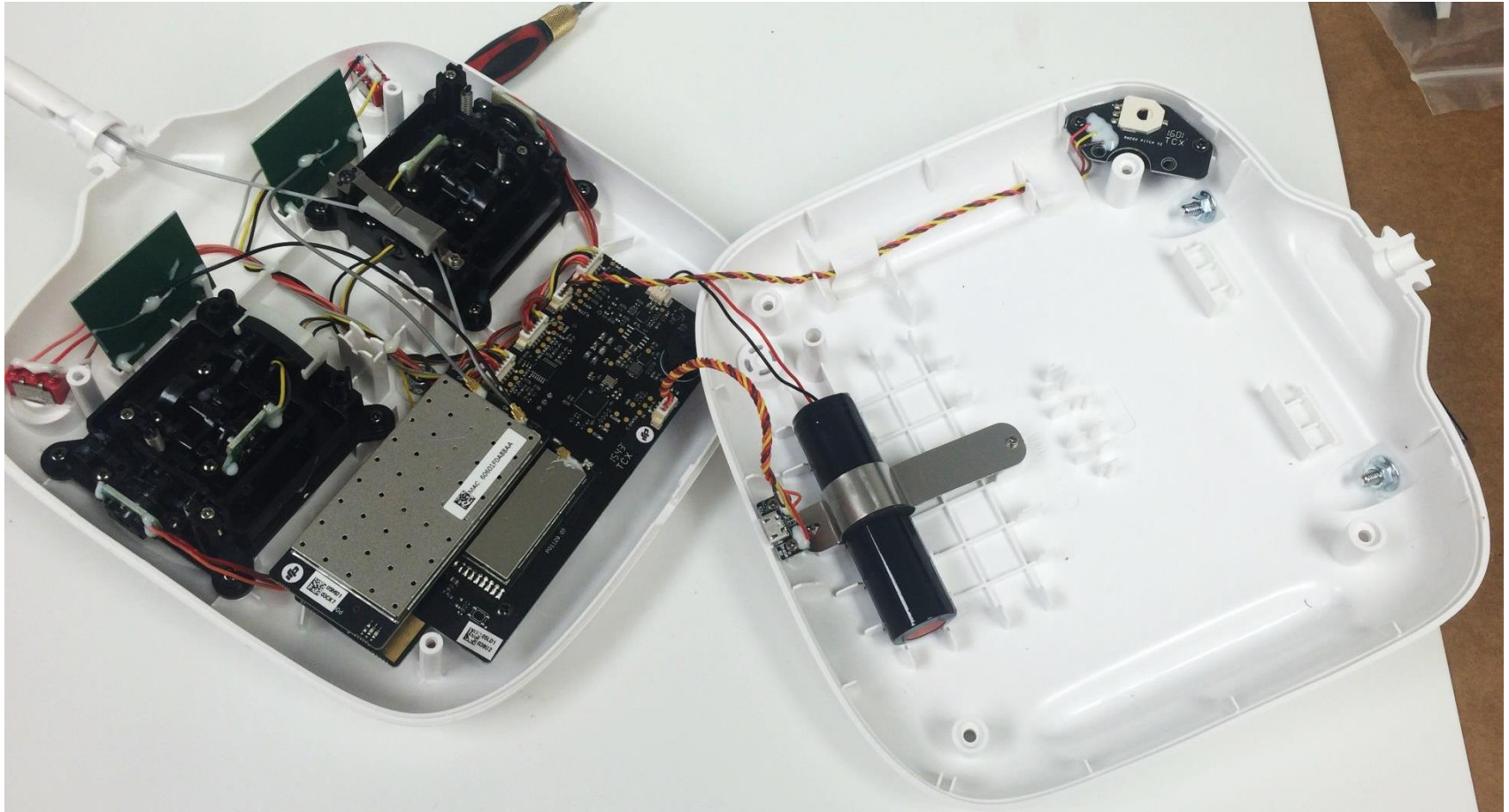
# Controller-Handle Bar



- 2x M2.5 screws (red)
  - Head Diameter: 0.164 in
  - Head Thickness: 0.057 in
  - Overall Length: 0.382 in
- Engage threaded inserts (purple)
- Phillips #0 driver



# Open Controller View

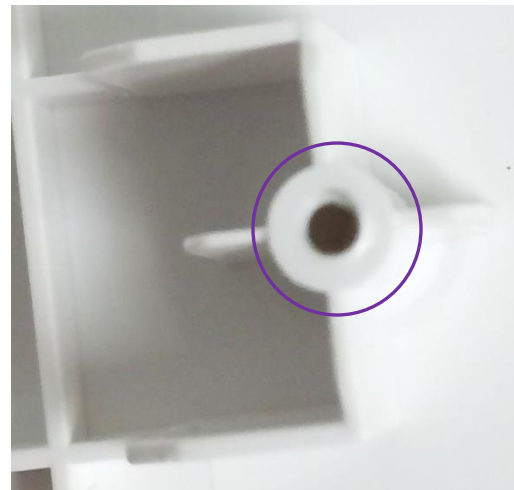




# Controller-Battery



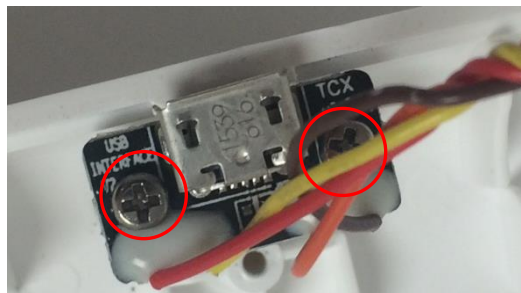
- 2x 1.2 mm screws (red)
  - Head Diameter: 0.128 in
  - Head Thickness: 0.052 in
  - Overall Length: 0.302 in
- Engage plastic bosses (purple)
- Phillips #000 driver



# Controller-USB

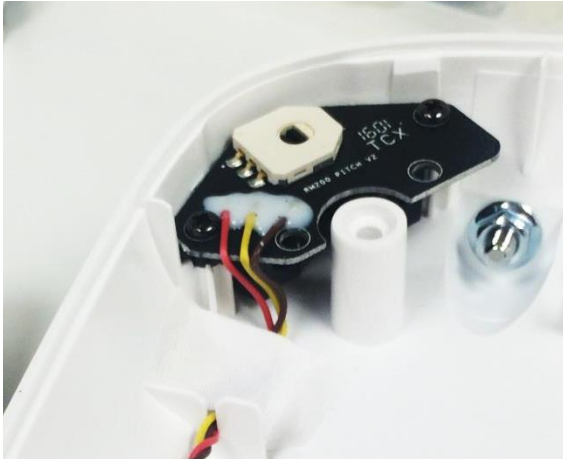


- 2x 2 mm screws (red)
  - Head Diameter: 0.131 in
  - Head Thickness: 0.048 in
  - Overall Length: 0.301 in
- Engage plastic bosses (purple)
- Phillips #000 driver

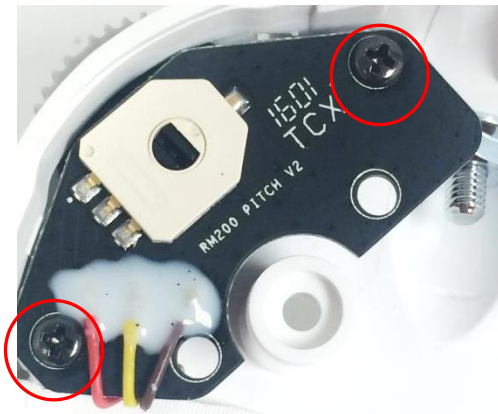




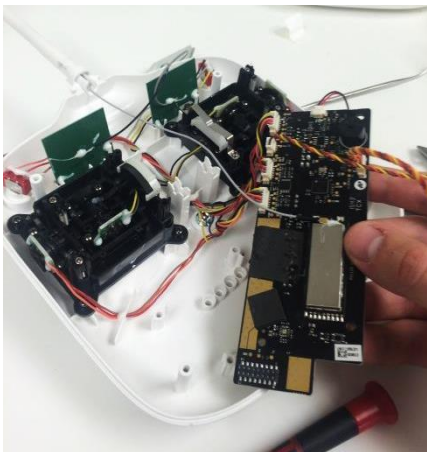
# Controller-Gimbal Dial



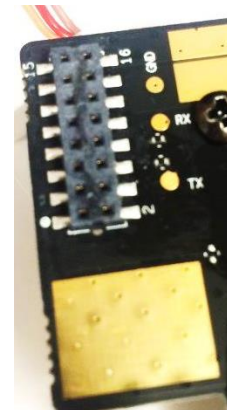
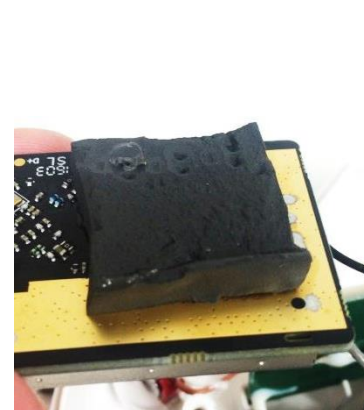
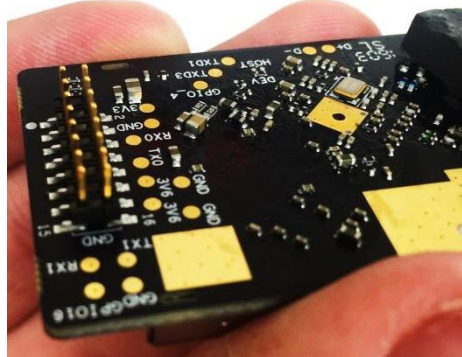
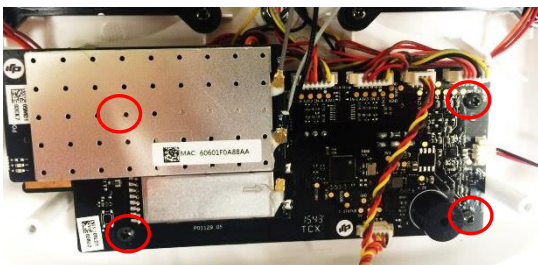
- 2x 2.5 mm high helix screws (red)
  - Head Diameter: 0.171 in
  - Head Thickness: 0.064 in
  - Overall Length: 0.495 in
- Engage plastic bosses (purple)
- Phillips #0 driver



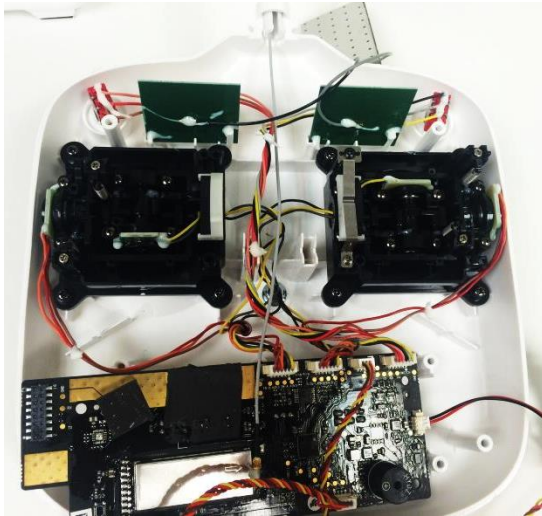
# Controller-Board w/ Battery



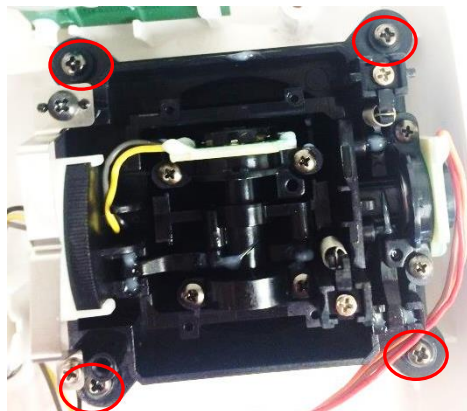
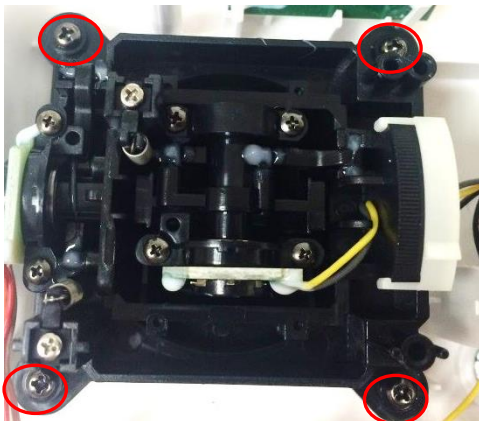
- 4x 3 mm screws (red, one not shown)
  - Head Diameter: 0.187 in
  - Head Thickness: 0.065 in
  - Overall Length: 0.294 in
- Engage plastic bosses
- Phillips #0 driver



# Controller-Left and Right Control Stick: Corners

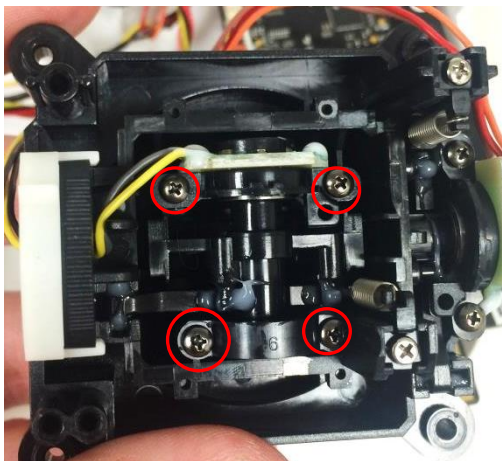


- 8x 2.5 mm screws (red)
  - Head Diameter: 0.171 in
  - Head Thickness: 0.071 in
  - Overall Length: 0.492 in
- Engage plastic bosses (purple)
- Phillips #0 driver

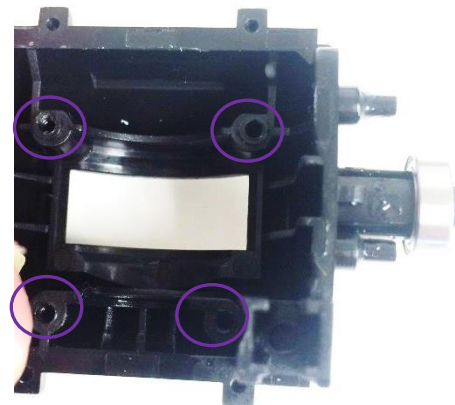
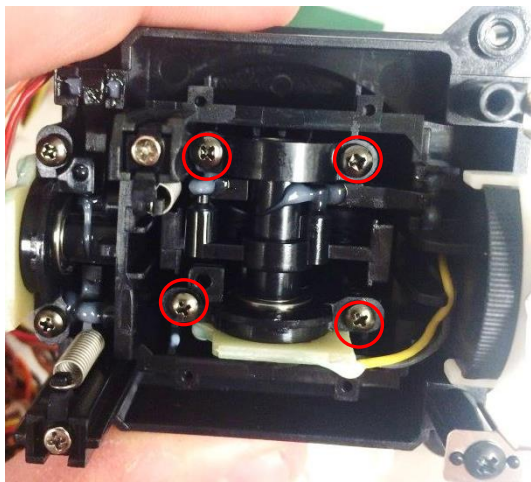




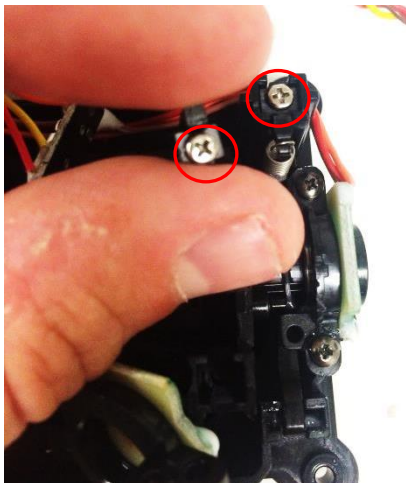
## Controller-Left and Right Control Stick: Inner Screws



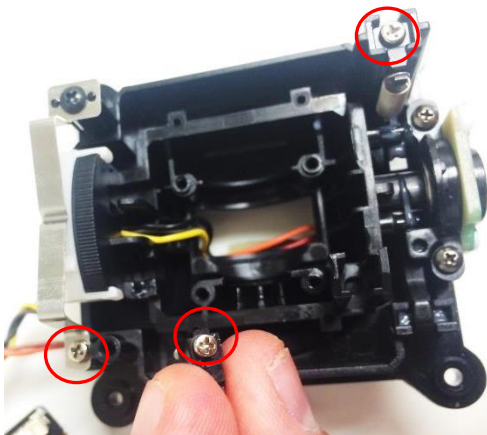
- 8x 2 mm screws (red, 4 longer, 4 shorter)
- Longer
  - Head Diameter: 0.152 in
  - Head Thickness: 0.060 in
  - Overall Length: 0.444 in
- Shorter
  - Head Diameter: 0.152 in
  - Head Thickness: 0.055 in
  - Overall Length: 0.331 in
- Engage plastic bosses (purple)
- Phillips #000 driver



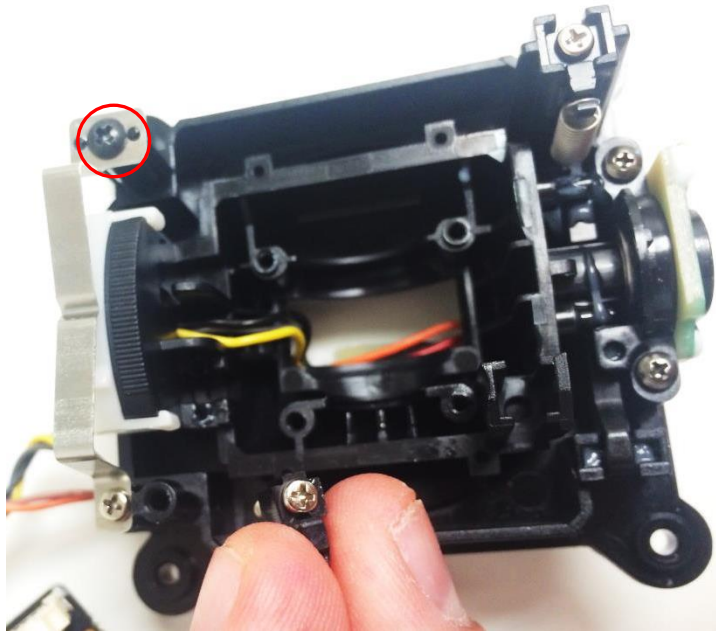
## Controller-Left and Right Control Stick: Silver Screws



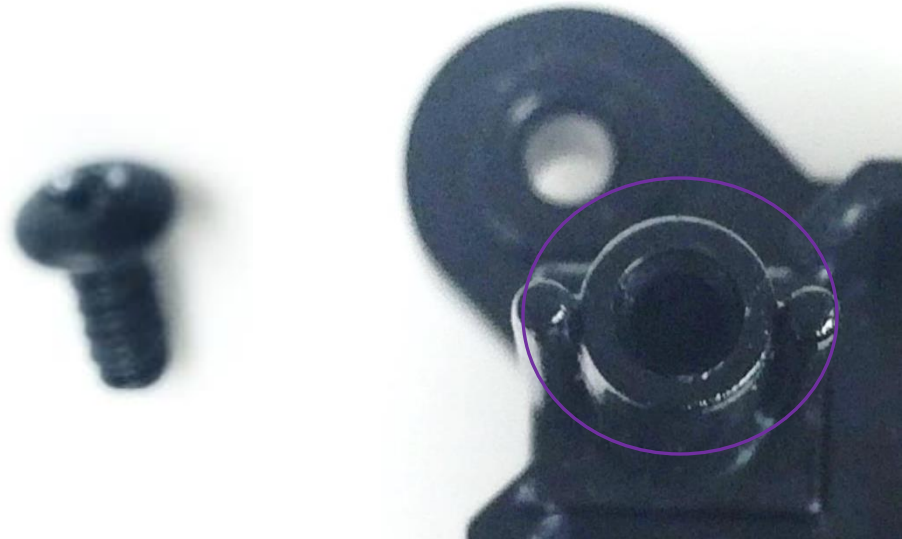
- 5x 2 mm screws (red, 4 longer, 1 shorter)
- Longer
  - Head Diameter: 0.133 in
  - Head Thickness: 0.055 in
  - Overall Length: 0.591 in
- Shorter
  - Head Diameter: 0.133 in
  - Head Thickness: 0.051 in
  - Overall Length: 0.440 in
- Engage plastic bosses (purple)
- Phillips #000 driver



# Controller-Right Control Stick: Black Screw

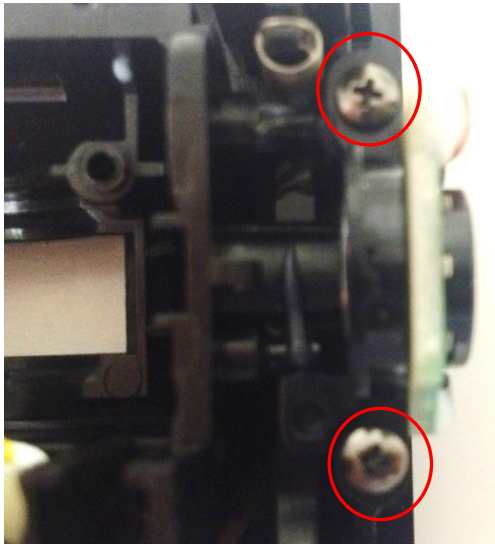


- 1x 2.5 mm screw (red)
  - Head Diameter: 0.175 in
  - Head Thickness: 0.062 in
  - Overall Length: 0.257 in
- Engages plastic boss (purple)
- Phillips #000 driver





## Controller-Left and Right Control Stick: Outer Screws



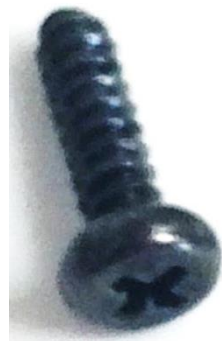
- 4x 2 mm screws (red)
  - Head Diameter: 0.151 in
  - Head Thickness: 0.057 in
  - Overall Length: 0.443 in
- Engage plastic bosses
- Phillips #00 driver



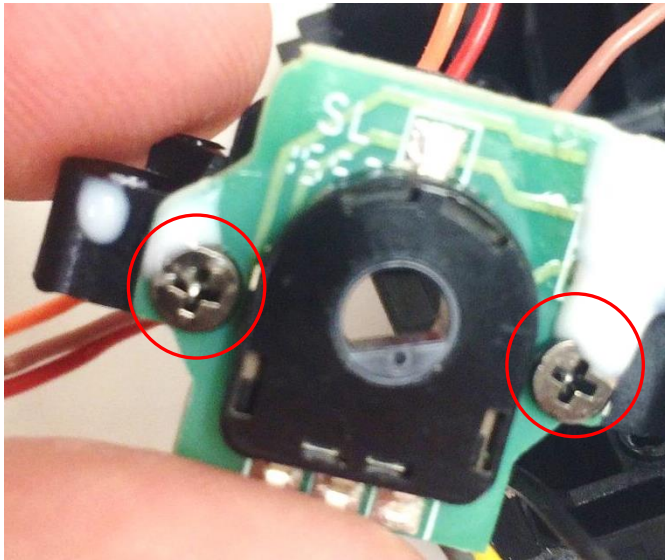
## Controller-Left and Right Control Stick: Screws Under Wheels



- 4x 2 mm screws (red)
  - Head Diameter: 0.153 in
  - Head Thickness: 0.057 in
  - Overall Length: 0.327 in
- Engage plastic bosses (purple)
- Phillips #00 driver



## Controller-Left and Right Joystick: Mini-Chip Screws



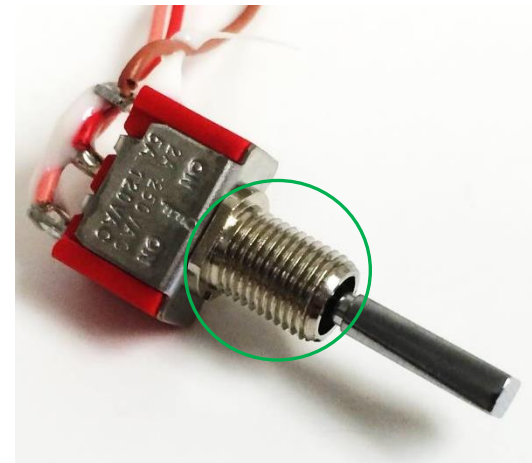
- 8x 1.6 mm screws (red)
  - Head Diameter: 0.138 in
  - Head Thickness: 0.040 in
  - Overall Length: 0.224 in
- Engage plastic bosses (purple)
- Adhesive pried off
- Phillips #00 driver



# Controller-Switches



- 2x M6 spanner nuts (blue)  
- Thickness: 0.206 in
- Engage threaded switches (green)



# Controller-Lanyard Loop



- 1x M4 serrated flanged hex nut (blue)  
- Thickness: 0.170 in
- Engages threaded lanyard loop (green)





# Controller-Top Handle

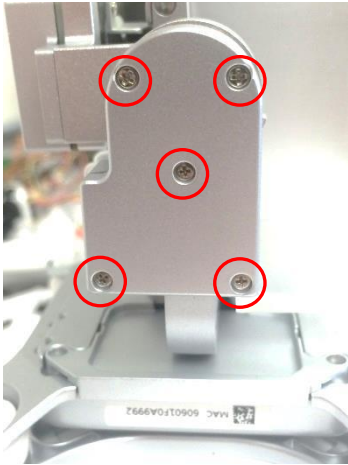


- 2x M4 serrated flanged hex nuts (blue)
  - Thickness: 0.169 in
- Engage threaded portions of handle (green)

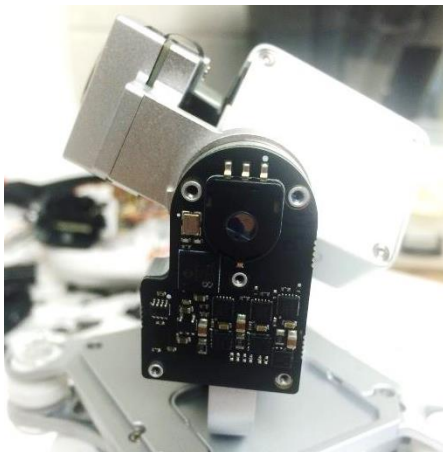




# Camera-Side Phillips Heads



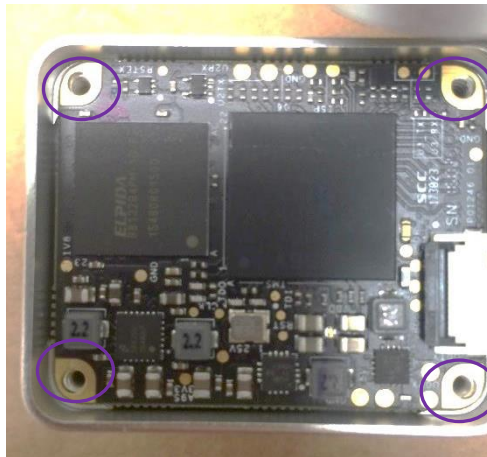
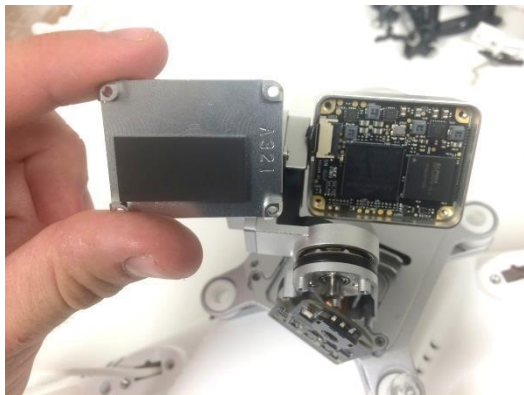
- 5x M2 screws (red)
  - Head Diameter: 0.107 in
  - Head Thickness: 0.033 in
  - Overall Length: 0.215 in
- Engage threaded bosses (purple)
- Phillips #0 driver
- Locking patch



# Camera-Side Torx



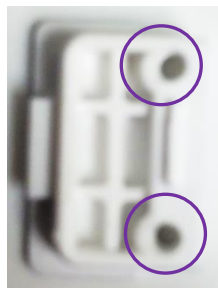
- 4x M2 screws (red)
  - Head Diameter: 0.147 in
  - Head Thickness: 0.050 in
  - Overall Length: 0.318 in
- Engage threaded bosses (purple)
- T7 torx driver
- Locking Patch



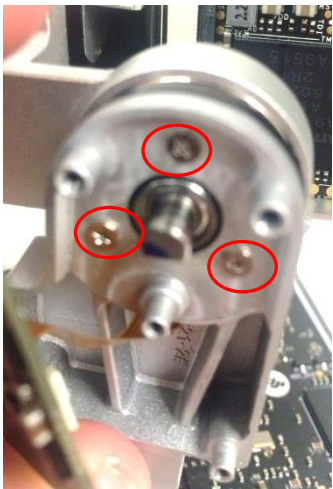
# Camera-Top Gimbal Mount



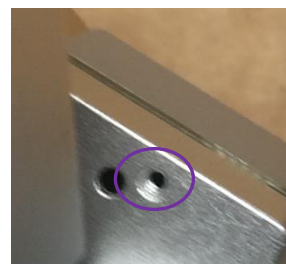
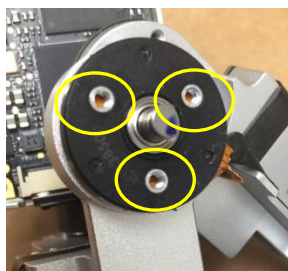
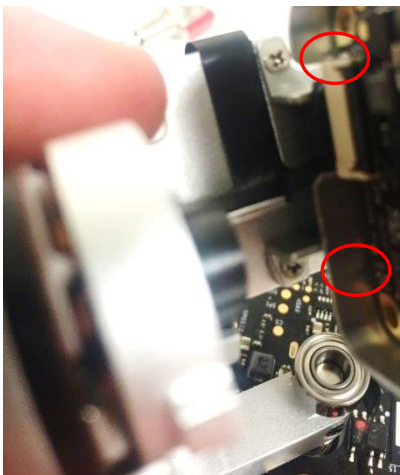
- 8x 2.5 mm screws (red, 3 longer, 5 shorter; 3 not shown)
- Longer
  - Head Diameter: 0.113 in
  - Head Thickness: 0.039 in
  - Overall Length: 0.351 in
- Shorter
  - Head Diameter: 0.114 in
  - Head Thickness: 0.037 in
  - Overall Length: 0.269 in
- 2x plastic locknuts w/ pins (blue) and 4x vibration absorbers (green)
- Engage plastic bosses (purple)
- Phillips #0 driver



# Camera-Other Screws



- 3x M2 screws and 2x M1.6 screws (red)
- M2's
  - Head Diameter: 0.114 in
  - Head Thickness: 0.017 in
  - Overall Length: 0.123 in
- M1.6's
  - Head Diameter: 0.115 in
  - Head Thickness: 0.020 in
  - Overall Length: 0.134 in
- M2's engage threaded inserts (yellow); M1.6's engage threaded bosses (purple)
- Phillips #00 driver
- M2's contain locking patch





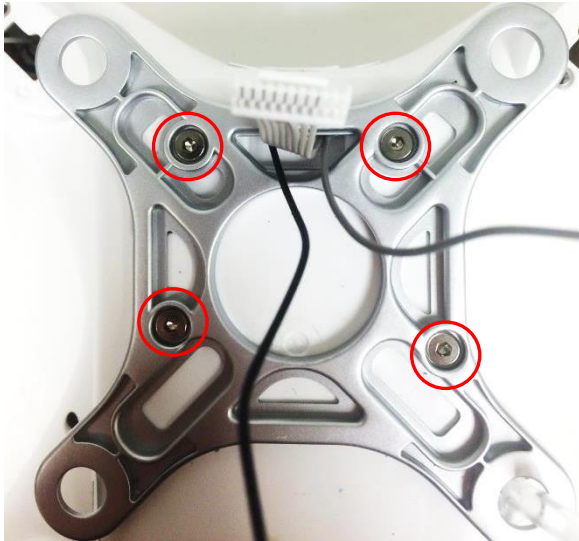
# Camera-Other Circuit Board Screws



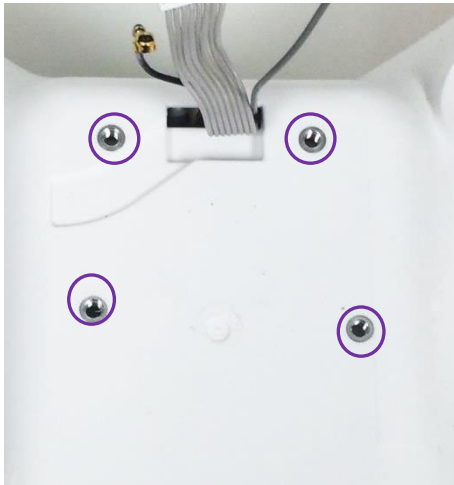
- 2x 2 mm screws (red)
  - Head Diameter: 0.175 in
  - Head Thickness: 0.019 in
  - Overall Length: 0.195 in
- Engage plastic bosses (purple)
- Phillips #00 driver



# Camera-Bottom Gimbal Mount

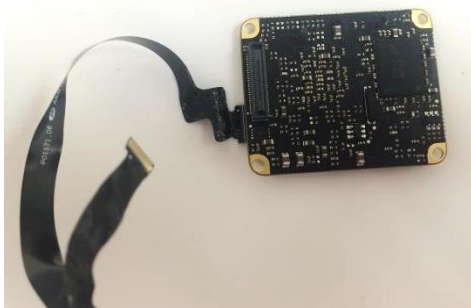


- 4x M3 screws (red)
  - Head Diameter: 0.214 in
  - Head Thickness: 0.047 in
  - Overall Length: 0.265 in
- Engage threaded inserts (purple)
- 5/64 hex driver
- Locking patch

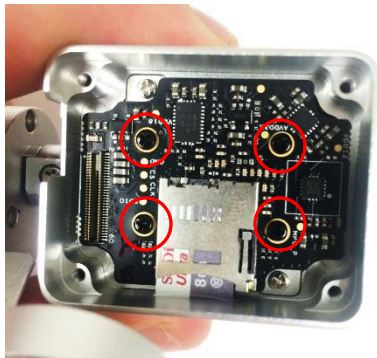




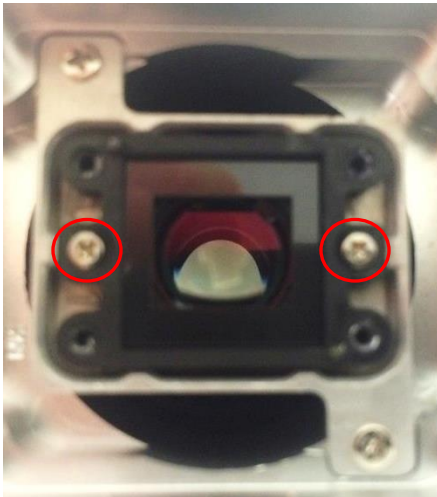
# Camera-Other Screws 3



- 4x 2mm screws (red)
  - Head Diameter: 0.114 in
  - Head Thickness: 0.039 in
  - Overall Length: 0.192 in
- Engage plastic bosses (purple)
- Phillips #00 driver



# Camera-Other Screws 4



- 2x M1.4 screws (red)
  - Head Diameter: 0.091 in
  - Head Thickness: 0.019 in
  - Overall Length: 0.212 in
- Engage threaded bosses (purple)
- Phillips #00 driver



# Camera-Other Screws 5



- 2x M2 screws (red)
  - Head Diameter: 0.110 in
  - Head Thickness: 0.033 in
  - Overall Length: 0.176 in
- Engage threaded bosses (purple)
- Phillips #00 driver
- Locking patch



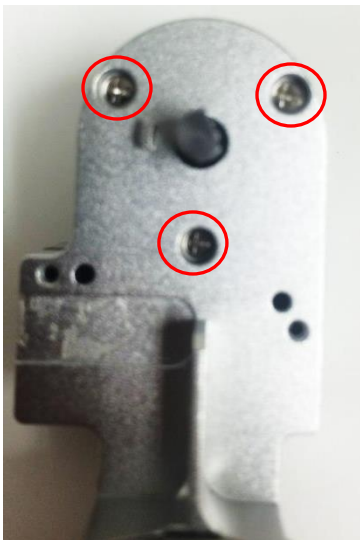
# Camera-Other Screws 6



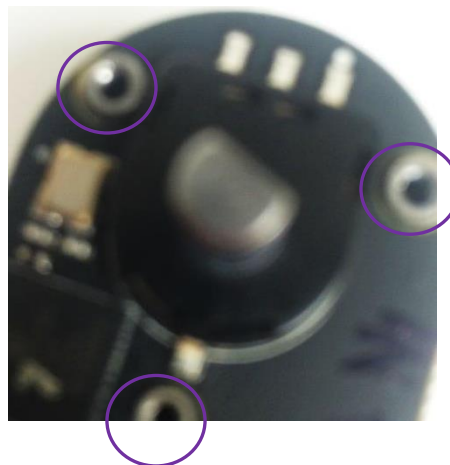
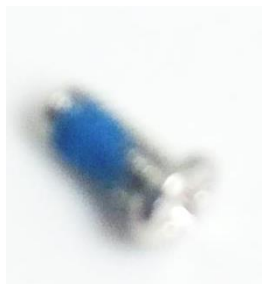
- 1x 2 mm screw (red)
  - Head Diameter: 0.132 in
  - Head Thickness: 0.038 in
  - Overall Length: 0.234 in
- Engages plastic boss (purple)
- Phillips #00 driver
- Locking patch



# Camera-Other Screws 7



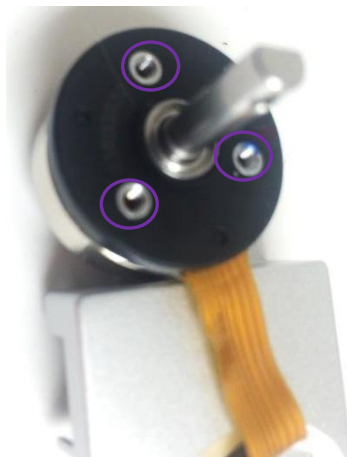
- 3x M2 screws (red)
  - Head Diameter: 0.115 in
  - Head Thickness: 0.038 in
  - Overall Length: 0.215 in
- Engage threaded inserts (purple)
- Phillips #00 driver
- Locking patch



# Camera-Other Screws 8



- 3x M2 screws (red)
  - Head Diameter: 0.172 in
  - Head Thickness: 0.016 in
  - Overall Length: 0.123 in
- Engage threaded inserts (purple)
- Phillips #00 driver
- Locking patch

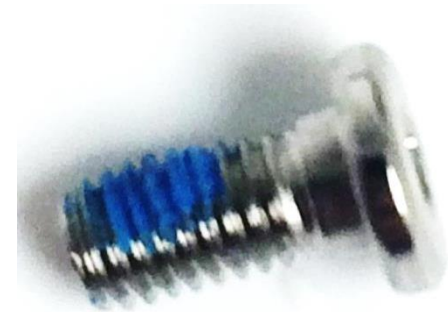




# Drone-External: Arms



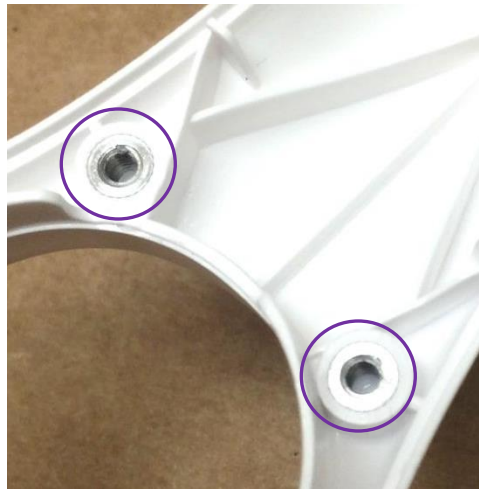
- 16x M3 screws (red)
  - Head Diameter: 0.211 in
  - Head Thickness: 0.085 in
  - Overall Length: 0.296 in
- Engage threaded bosses (purple)
- 5/64 hex driver
- Locking patch



# Drone-External: Arms (cont.)



- 8x M2.5 screws (red)
  - Head Diameter: 0.193 in
  - Head Thickness: 0.046 in
  - Overall Length: 0.238 in
- Engage threaded inserts (purple)
- T8 torx driver
- Locking patch



# Drone-External: Arms (cont.)



- 4x 2 mm screws (red)
  - Head Diameter: 0.154 in
  - Head Thickness: 0.058 in
  - Overall Length: 0.331 in
- Engage plastic bosses (purple)
- T6 torx driver



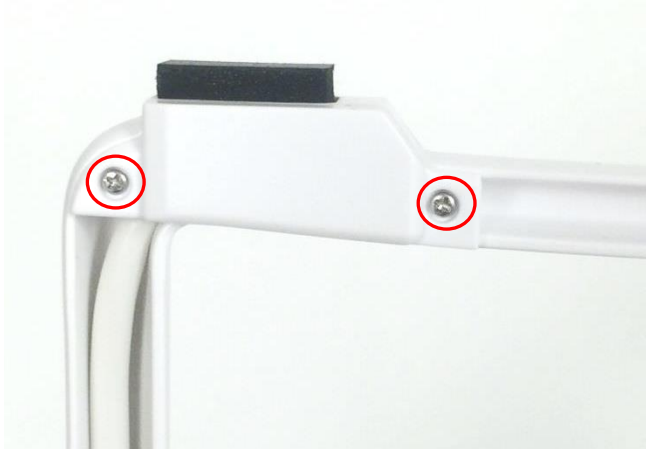
# Drone-External: Landing Gear Base



- 8x M2 screws (red)
  - Head Diameter: 0.212 in
  - Head Thickness: 0.049 in
  - Overall Length: 0.351 in
- Engage threaded inserts (purple)
- T8 torx driver
- Locking patch



# Drone-External: Landing Gear Top

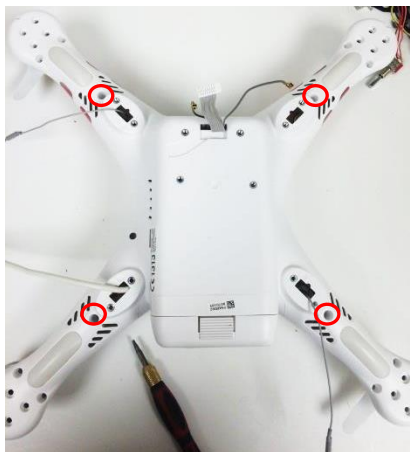


- 2x 1.6 mm screws (red)
  - Head Diameter: 0.093 in
  - Head Thickness: 0.045 in
  - Overall Length: 0.224 in
- Engage plastic bosses (purple)
- Phillips #0 driver





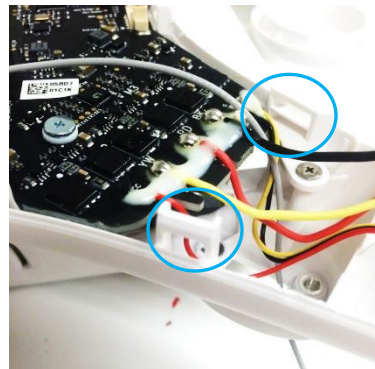
# Drone-External: Deep Screws



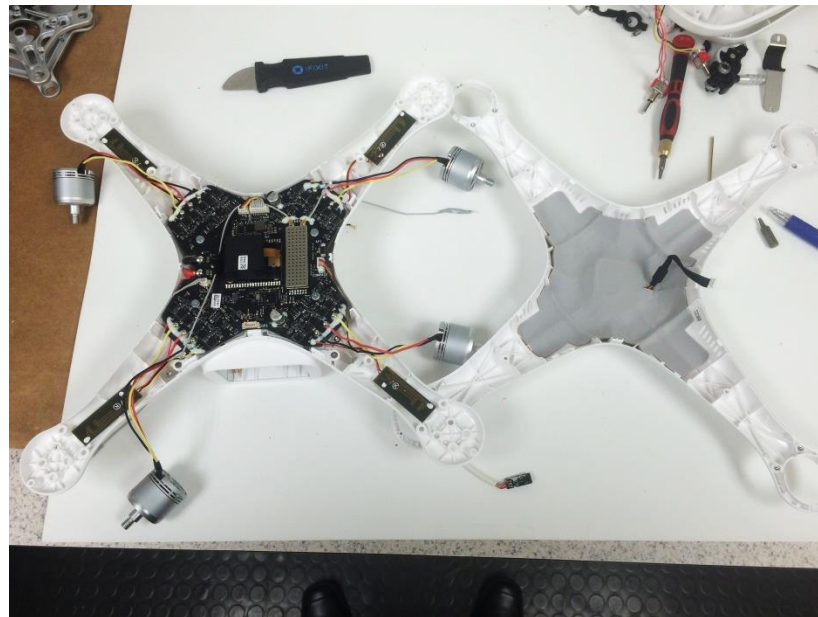
- 4x 3 mm high helix screws (red)
  - Head Diameter: 0.188 in
  - Head Thickness: 0.070 in
  - Overall Length: 0.456 in
- Engage plastic bosses (purple)
- T9 torx driver



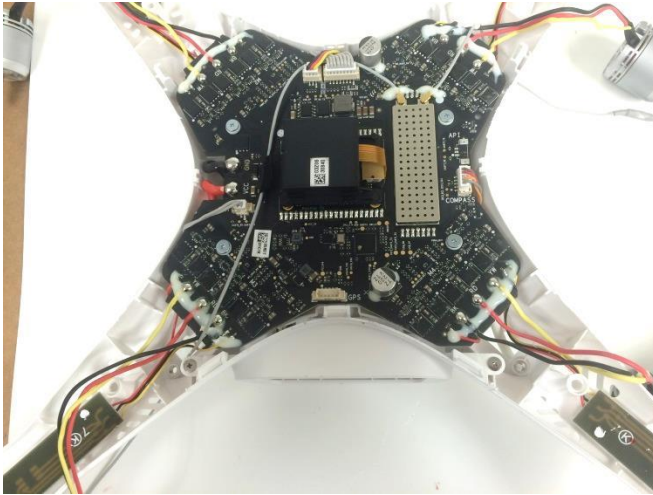
# Opening of Drone



- 10x plastic snaps (blue)



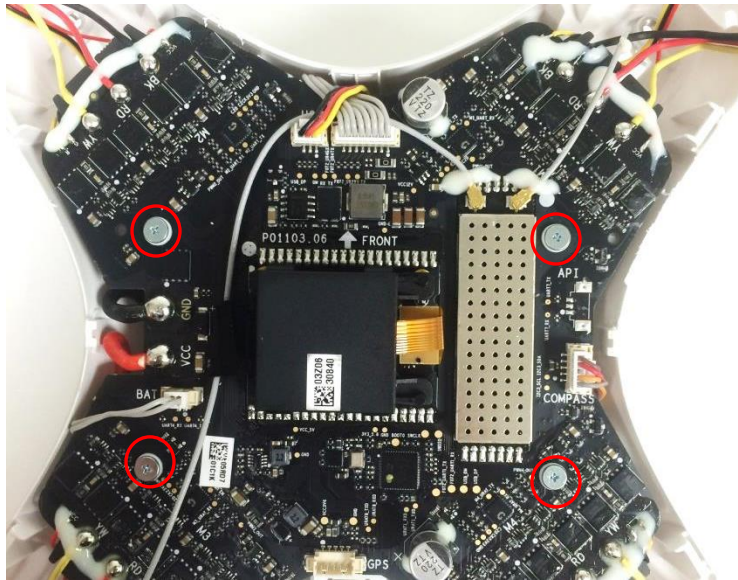
# Drone-Internal



- 2x 2 mm screws (red)
  - Head Diameter: 0.180 in
  - Head Thickness: 0.019 in
  - Overall Length: 0.135 in
- Engage plastic bosses (purple)
- Phillips # 0 driver



# Drone-Internal: Main Board Screws

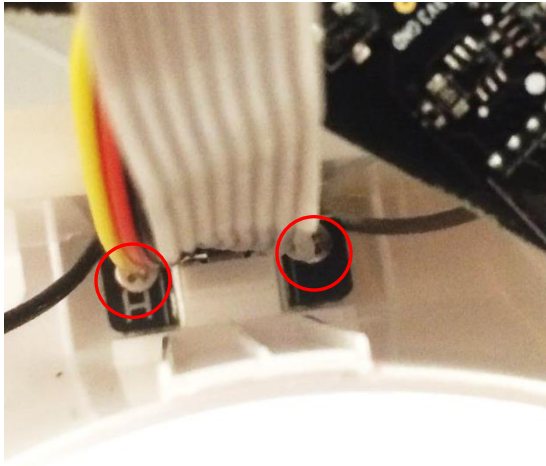


- 4x 1.6 mm screws (red)
  - Head Diameter: 0.199 in
  - Head Thickness: 0.038 in
  - Overall Length: 0.287 in
- Engage plastic bosses (purple)
- Phillips #0 driver
- Rubber bushings to dampen vibrations

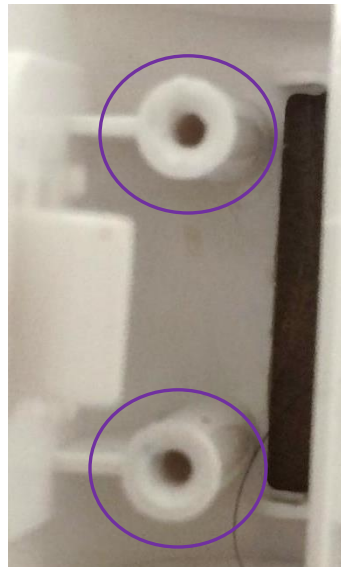




# Drone-Internal

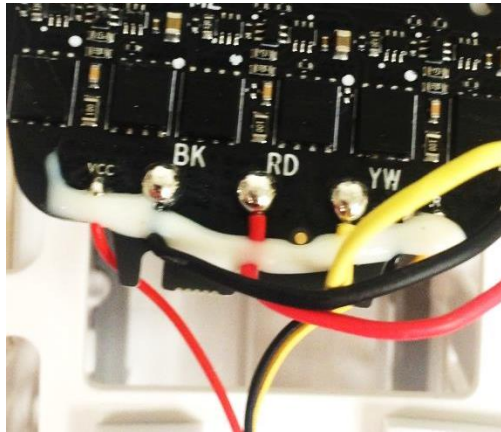


- 4x 1.6 mm screws (red)
  - Head Diameter: 0.110 in
  - Head Thickness: 0.023 in
  - Overall Length: 0.160 in
- Engage plastic bosses (purple)
- Phillips #0 driver

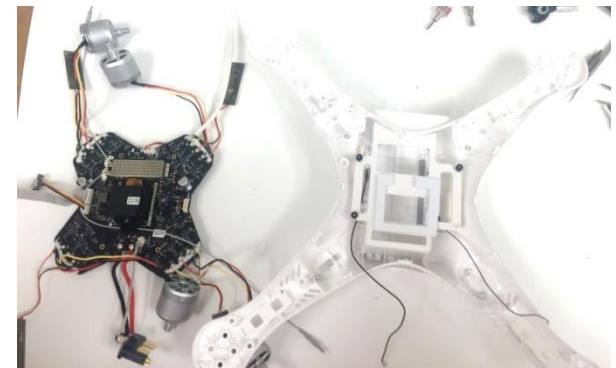
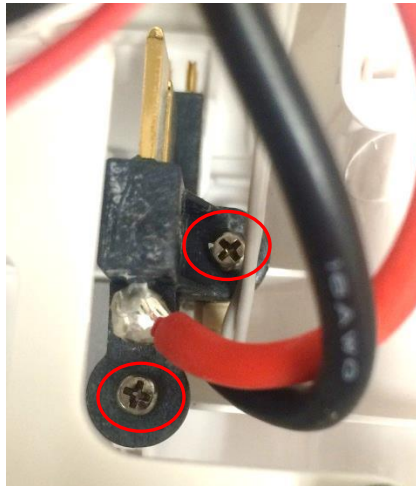




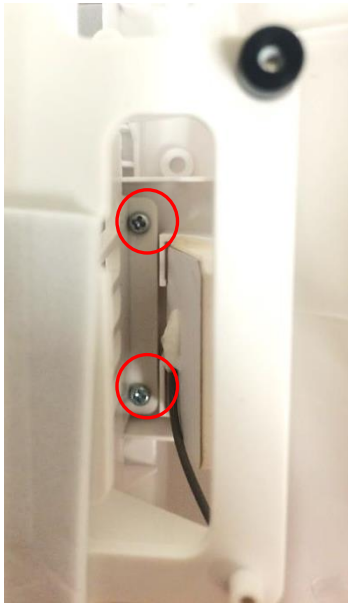
# Drone-Internal: BK/RD Connection



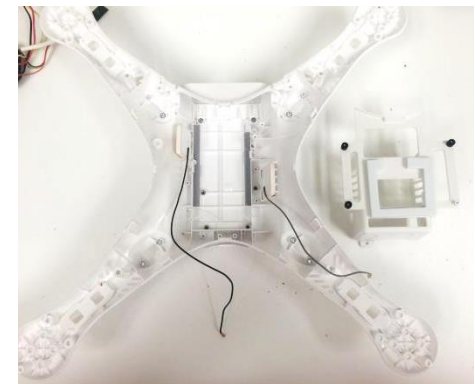
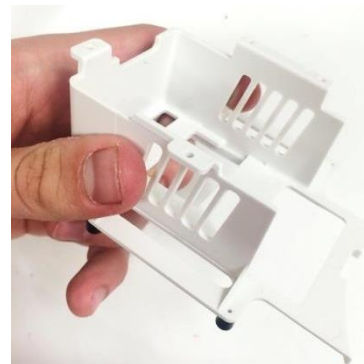
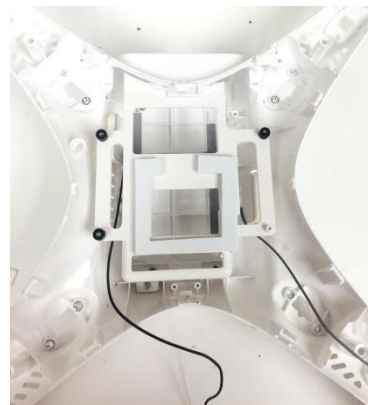
- 2x 2 mm screws (red)
  - Head Diameter: 0.133 in
  - Head Thickness: 0.050 in
  - Overall Length: 0.301 in
- Engage plastic bosses (purple)
- Phillips #0 driver



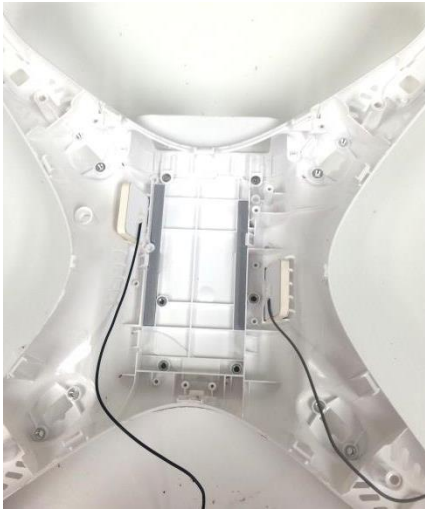
# Drone-Internal: Battery Mount



- 4x 2 mm screws (red)
  - Head Diameter: 0.138 in
  - Head Thickness: 0.058 in
  - Overall Length: 0.237 in
- Engage plastic bosses
- Phillips #00 driver



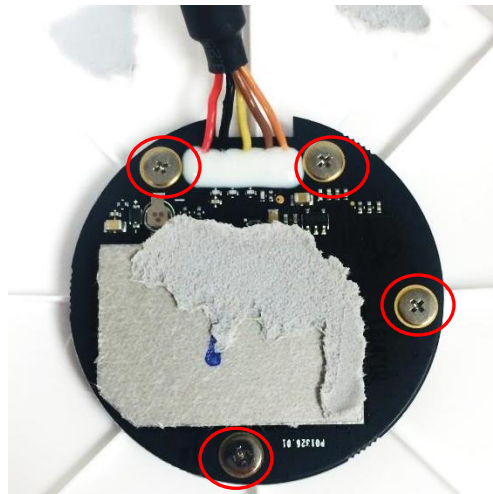
# Drone-Internal: Bottom of Chassis



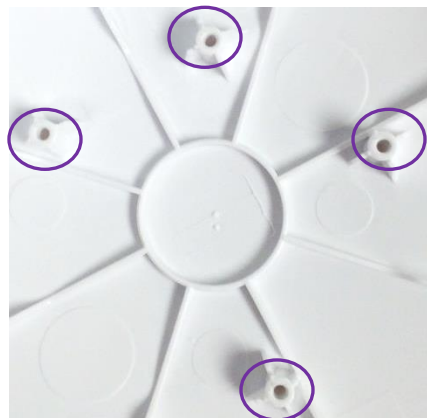
- 2x M2 screws (red)
  - Head Diameter: 0.163 in
  - Head Thickness: 0.021 in
  - Overall Length: 0.134 in
- Engage threaded inserts (purple)
- Phillips #00 driver



# Drone-Internal: GPS



- 4x 1.6 mm screws (red)
  - Head Diameter: 0.177 in
  - Head Thickness: 0.019 in
  - Overall Length: 0.139 in
- Engage plastic bosses (purple)
- Phillips #00 driver



# Fastener Summary





# Fastener Summary

<u>Part</u>	<u>Qty.</u>	<u>Head Dia.</u>	<u>Head Thk</u>	<u>Ovl. Length</u>	<u>Thd Dia.</u>	<u>Thd Length</u>	<u>Drive</u>	<u>Patch (Y or N)</u>	<u>Magnetic (Y or N)</u>	<u>Thread Size</u>	<u>Slide #</u>
<b>Controller</b>											
Back of controller	4	0.187	0.061	0.453	0.116	0.392	PH0	N	Y	3 mm	4
Handle Bar	2	0.164	0.057	0.382	0.096	0.325	PH0	N	Y	M2.5	5
Battery	2	0.128	0.052	0.302	0.040	0.250	PH000	N	Y	1.2 mm	7
USB	2	0.131	0.048	0.301	0.078	0.253	PH000	N	Y	2 mm	8
Gimbal dial	2	0.171	0.064	0.495	0.091	0.431	PH0	N	Y	2.5 mm	9
Board w/ battery	4	0.187	0.065	0.294	0.116	0.229	PH0	N	Y	3 mm	10
L & R. joystick 4 corners	8	0.171	0.071	0.492	0.092	0.421	PH0	N	Y	2.5 mm	11
L & R. control stick longer screws	4	0.152	0.060	0.444	0.078	0.384	PH000	N	Y	2 mm	12
L & R. control stick shorter screws	4	0.152	0.055	0.331	0.078	0.276	PH000	N	Y	2 mm	12
L & R. control stick silver screws, long	4	0.133	0.055	0.591	0.075	0.536	PH000	N	Y	2 mm	13
L & R. control stick silver screws, short	1	0.133	0.051	0.440	0.076	0.389	PH000	N	Y	2 mm	13
R. control stick black screw	1	0.175	0.062	0.257	0.091	0.195	PH000	N	Y	2.5 mm	14
L & R. control stick outer screws	4	0.151	0.057	0.443	0.077	0.386	PH00	N	Y	2 mm	15
L & R. control stick screws under wheels	4	0.153	0.057	0.327	0.078	0.270	PH00	N	Y	2 mm	16
L & R. control stick mini-chip screws	8	0.138	0.040	0.224	0.058	0.184	PH00	N	Y	1.6 mm	17
<b>Drone-External</b>											
Arm groups of 4	16	0.211	0.085	0.296	0.116	0.211	5/64 Hex	Y	Y	M3	33
Arm groups of 2	8	0.193	0.046	0.238	0.098	0.192	T8	Y	Y	M2.5	34
Arm groups of 1	4	0.154	0.058	0.331	0.077	0.273	T6	N	Y	2 mm	35
Landing gear base	8	0.212	0.049	0.351	0.078	0.302	T8	Y	Y	M2	36
Landing gear top	2	0.093	0.045	0.224	0.056	0.179	PH0	N	N	1.6 mm	37
Deep screws	4	0.188	0.070	0.456	0.118	0.386	T9	N	Y	3 mm	38



<u>Part</u>	<u>Qty.</u>	<u>Head Dia.</u>	<u>Head Thk</u>	<u>Ovl. Length</u>	<u>Thd Dia.</u>	<u>Thd Length</u>	<u>Drive</u>	<u>Patch (Y or N)</u>	<u>Magnetic (Y or N)</u>	<u>Thread Size</u>	<u>Slide #</u>
<b>Drone-Camera</b>											
Camera side phillips heads	5	0.107	0.033	0.215	0.073	0.182	PH0	Y	Y	M2	21
Side camera	4	0.147	0.050	0.318	0.077	0.268	T7	Y	Y	M2	22
Camera top gimbal mount longer	3	0.113	0.039	0.351	0.079	0.312	PH0	N	Y	2.5 mm	23
Camera top gimbal mount shorter	5	0.114	0.037	0.269	0.079	0.232	PH0	N	Y	2.5 mm	23
Other camera screws 1	3	0.114	0.017	0.123	0.075	0.106	PH00	Y	Y	M2	24
Other camera screws 2	2	0.115	0.020	0.134	0.060	0.114	PH00	N	Y	M1.6	24
Other camera ckt. brd. Screws	2	0.175	0.019	0.195	0.078	0.176	PH00	N	Y	2 mm	25
Camera bottom gimbal mount	4	0.214	0.047	0.265	0.116	0.218	5/64 hex	Y	Y	M3	26
Other camera screws 3	4	0.114	0.039	0.192	0.064	0.153	PH00	N	Y	2 mm	27
Other camera screws 4	2	0.091	0.019	0.212	0.052	0.193	PH00	N	Y	M1.4	28
Other camera screws 5	2	0.110	0.033	0.176	0.074	0.143	PH00	Y	Y	M2	29
Other camera screws 6	1	0.132	0.038	0.234	0.077	0.196	PH00	Y	Y	2 mm	30
Other camera screws 7	3	0.115	0.038	0.215	0.074	0.177	PH00	Y	Y	M2	31
Other camera screws 8	3	0.112	0.016	0.123	0.076	0.107	PH00	Y	Y	M2	32
<b>Drone-Internal</b>											
Location 1	2	0.180	0.019	0.135	0.078	0.116	PH0	N	Y	2 mm	40
Main Board Screws	4	0.199	0.038	0.287	0.061	0.249	PH0	N	Y	1.6 mm	41
Location 2	2	0.110	0.023	0.160	0.060	0.137	PH0	N	Y	1.6 mm	42
BK/RD connection	2	0.133	0.050	0.301	0.078	0.251	PH0	N	Y	2 mm	43
Battery Mount	4	0.138	0.058	0.237	0.075	0.179	PH00	N	Y	2 mm	44
Bottom of chassis	2	0.163	0.021	0.134	0.078	0.113	PH00	N	Y	M2	45
GPS	4	0.177	0.019	0.139	0.056	0.120	PH00	N	Y	1.6 mm	46
Total	159										

- Other fasteners used

- 2x plastic pins w/ snap locks
- 2x M6 nuts, 0.206 in. thick
- 3x M4 nut, 0.170 in. thick
- 10x plastic snaps
- 43x threaded inserts
  - 2x M1.4
  - 2x M1.6
  - 25x M2
  - 10x M2.5
  - 4x M3

# Alternate Solutions

PennEngineering® recommendations  
of alternate hardware and cost savings  
opportunities.



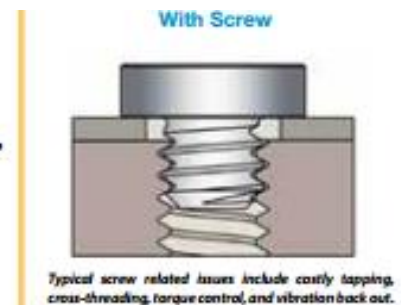
# PEM Manufacturing Capability

- It should be noted that PEM can make any existing fastener used in this drone
  - <http://www.pemnet.com/>



# Permanent Fasteners

- This drone was not designed for reparability, so it would make sense to use permanent fasteners, especially for internal components.



# VariMount Fasteners

- Since most of the screws engage into threaded inserts and bosses, VariMount Fasteners could possibly be utilized to reduce costs of designing bosses into the chassis of the drone and its controller.



# Conclusions and Summary

# Conclusion and Summary

- The DJI Phantom 3 is a very interesting, aesthetically appealing device that is part of a quickly growing market. Due to the sensitivity of the electronics used in this drone, DJI seems to not want people to easily be able to open it. This is evident by the amount of adhesive used, along with difficulty to open clips and screws with various types of drivers. With this in mind, it would make sense for DJI to incorporate permanent fasteners into their design to reduce the costs of machining bosses, tapping holes, etc. Alternatively, it may also make sense for them to make use of VariMount standoffs to cut down some of these costs.