

 **BACK-BONE**

Ribcage Installation

Part 2 - Assembly

Back-Bone
V1.06



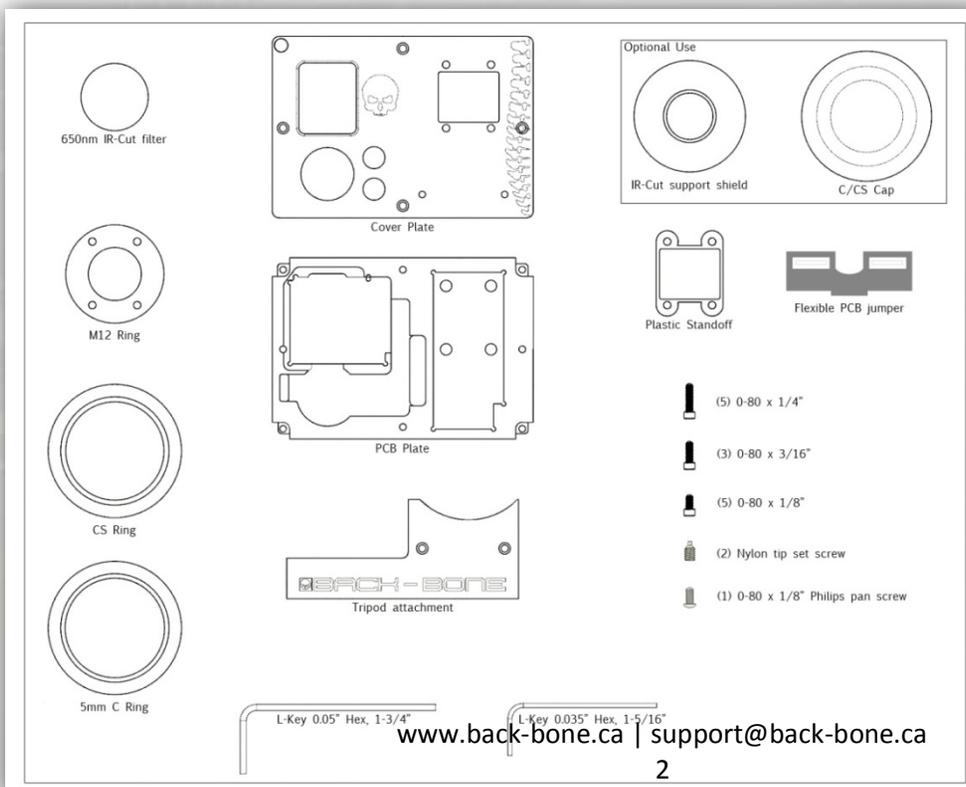
Contents

Section 1 – Before You Get Started.....	2
Included With Your Kit:.....	2
Figure: A	3
CAUTION!	4
Note:	4
Tools Required.....	5
Section 2: Ribcage Assembly.....	6
2-1 Your Ribcage Kit.....	6
2-2 Transfer the LED and power buttons	7
2-3 Attach LCD/Button Strip	9
2-4 Attach CMOS Sensor to Cover Plate.....	10
Permanent IR-Cut Placement.....	14
Removable IR-Cut Placement.....	14
2-5 Attach the Cover Plate to the PCB Plate.....	17
2-6 Connect flexible PCB jumper to PCB plate.	18
A Note for Hero3+ Installations:.....	20
2-7 Functionality Test	25
2-8 Put Ribcage Assembly Back Into Housing	26
2-9 Release Cover Plate Screws	28
2-10 Insert Original Corner Screws.....	29
2-11 Screw on Cover Plate	30
2-12 Insert Set Screw Into M12 Ring.....	32
2-13 Attach CS-Mount Ring.....	33
2-14 Re-attach Battery and Accessories	35
2-15 Install IR Cut Filter and Holder	36
2-16 Attach C-Mount Ring	37
2-17 Attach Tripod Mount	38
2-19 Done!.....	39

Section 1 – Before You Get Started

Included With Your Kit:

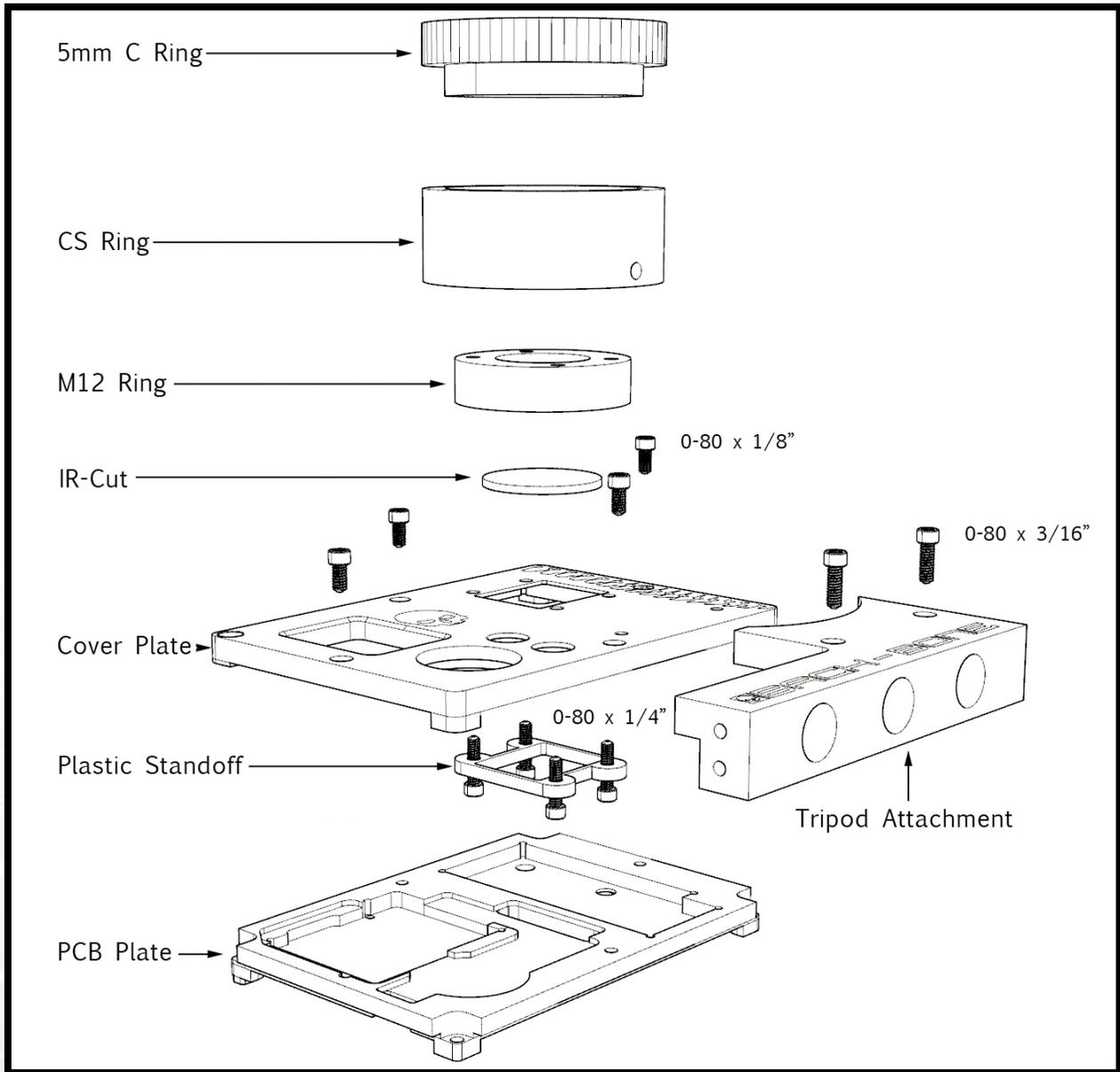
<u>ITEM</u>	<u>DESCRIPTION</u>	<u>QUANTITY</u>
1.	Cover plate	1
2.	PCB plate	1
3.	Tripod attachment	1
4.	650nm IR-cut filter	1
5.	M12 ring	1
6.	CS ring	1
7.	C ring	1
8.	Plastic standoff	1
9.	Flexible PCB jumper	1
10.	IR-cut support shield	1
11.	Plastic C/CS cap	1
12.	L-key 0.050" Hex	1
13.	L-key 0.035" Hex	1
14.	0-80 x 1/4" Hex socket screw	5
15.	0-80 x 3/16" Hex socket screw	3
16.	0-80 x 1/8" Hex socket screw	5
17.	Nylon tip set screw	2
18.	0-80 x 1/8" Philips pan screw	1



Important Note:

As of May 2014 the screw packet has been simplified to contain 6 x black 3/16" Hex screws and 4 x 1/4" stainless steel Philips screws for mounting the M12 ring. In these kits no 1/8" screws are provided and the screws for the cover plate and tripod plate are the same.

Figure: A



Important Note:

As of May 2014 the screw packet has been simplified to contain 6 x black 3/16" Hex screws and 4 x 1/4" stainless steel Philips screws for mounting the M12 ring. In these kits no 1/8" screws are provided and the screws for the cover plate and tripod plate are the same.

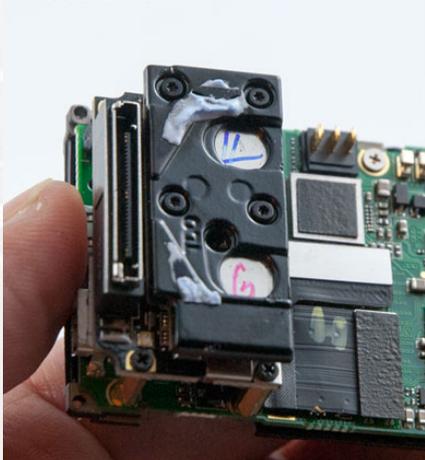
CAUTION!

1. Read all our documentation thoroughly before beginning your installation
2. This kit is for the Hero3 Black and Hero3+ Black only. No other models are supported.
3. Make sure to charge your battery before beginning the installation.
4. NEVER force or exert force on any components. IF YOU FEEL THE NEED TO USE FORCE THAN YOU'RE DOING SOMETHING WRONG.
5. The Ribcage DIY kit consists of highly machined parts and fine threaded through holes. NEVER FORCE any screws as this can strip the fine threads on the through holes. Instead check your assembly and registration and try again. All parts are highly accurate and DO NOT require force to assemble.
6. Ensure your work area is clean, well lit and free from dust.
7. We recommend inspecting and removing any dust or debris from the parts before you begin.
8. Never over tighten any of the small screws, especially on the faceplate and tripod mount. Excessive force or over tightening can result in stripped threads on the aluminum parts. Always loosely fit all screws in place before screwing them in until seated. Additional tightening is not required.
9. By applying this or any modifications to your GoPro devices you will **VOID** any warranties
10. Back-Bone takes no responsibility in your ability to use this modification
11. The Ribcage DIY kit is provide "as is" and without warranty
12. Disclaimer: Ribcage is a product of Back-Bone, and is not manufactured, distributed or endorsed by Woodman Labs, Inc the maker of GoPro and Hero Products.

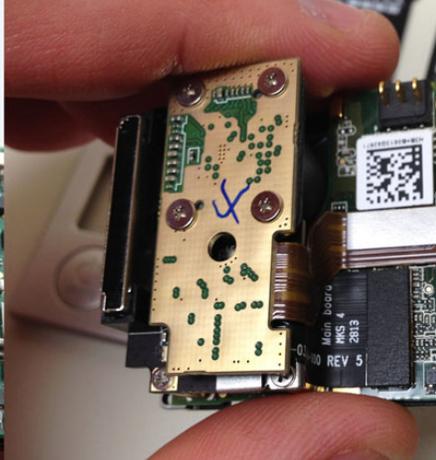
Note:

We should point out that the teardown was performed on the Hero3 Black, and the assembly was performed on the Hero3+ Black, so there are some slight visual differences. Most notably the Hero3 has a much different looking image sensor board than the Hero3+. It has a thick dark backing attached. It is not necessary to remove this backing as the Ribcage was designed with enough room for it to fit.

Hero3 Black



Hero3+ Black



Tools Required

Before you begin you will need to gather the following tools:

- A Torx T4 screw driver (not required for Hero3+)
- A set of small precision screw drivers with a Phillips #0
- Lens / CCD Cleaner, Puffer & Lens Cloth (Optional but recommended)
- A utility knife
- A roll of electric tape
- 3M Double Sided Tape (Optional) *Note: don't use thick mounting tape – use only thin double sided tape or the parts may not fit correctly.*
- A small file, or nail file (For Hero3+)



Section 2: Ribcage Assembly

2-1 Your Ribcage Kit

Video: <http://youtu.be/Tz3vMLKMPJE?t=7m41s>

Remove the two screws holding on the tripod mount and the cover plate. You can use your own tools or the L-keys provided. The IR-Cut filter and plastic standoff are stored inside.



For a complete list of parts and hardware please refer to pages 2 and 3 of this guide.



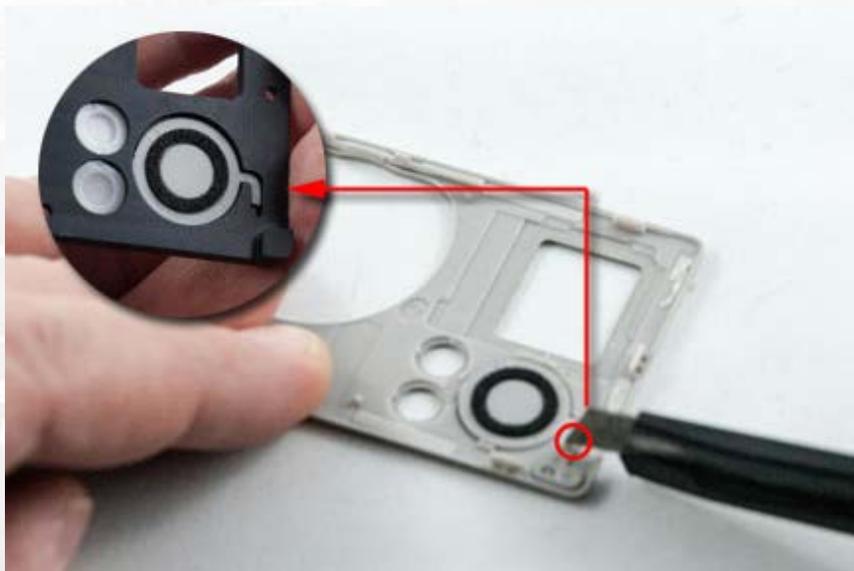
2-2 Transfer the LED and power buttons

Video: <http://youtu.be/Tz3vMLKMPJE?t=8m52s>

Next we'll remove the LED covers from the original faceplate. Take a blunt, non-metallic tool such as the end of a pen and apply pressure to the edges until they come free.



Turn the faceplate over and use a utility knife to cut the tab connecting the power button as pictured.



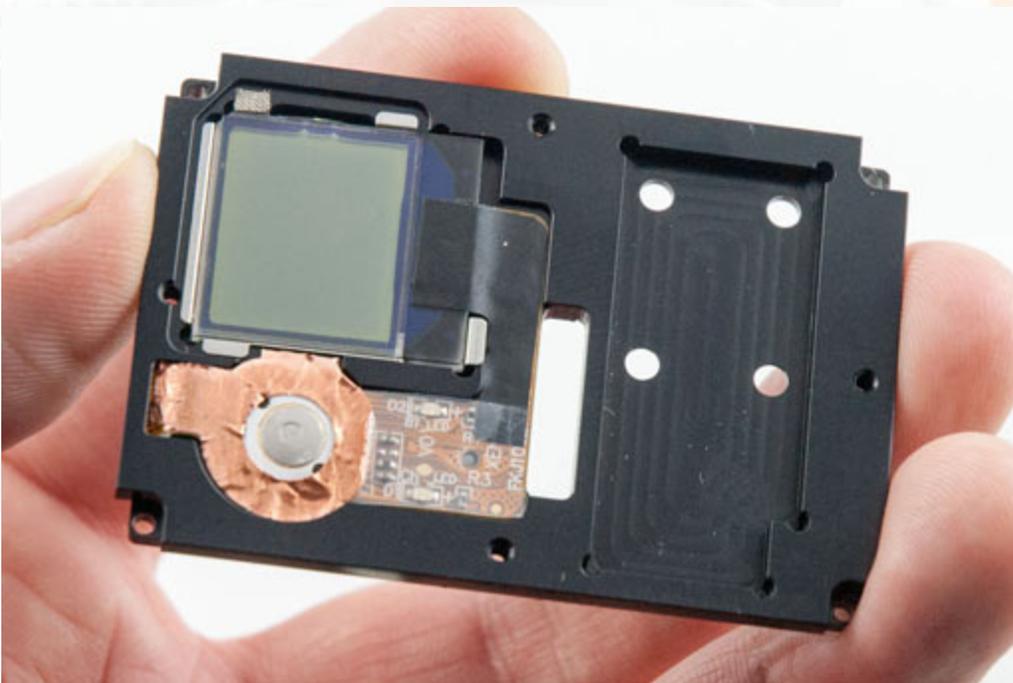
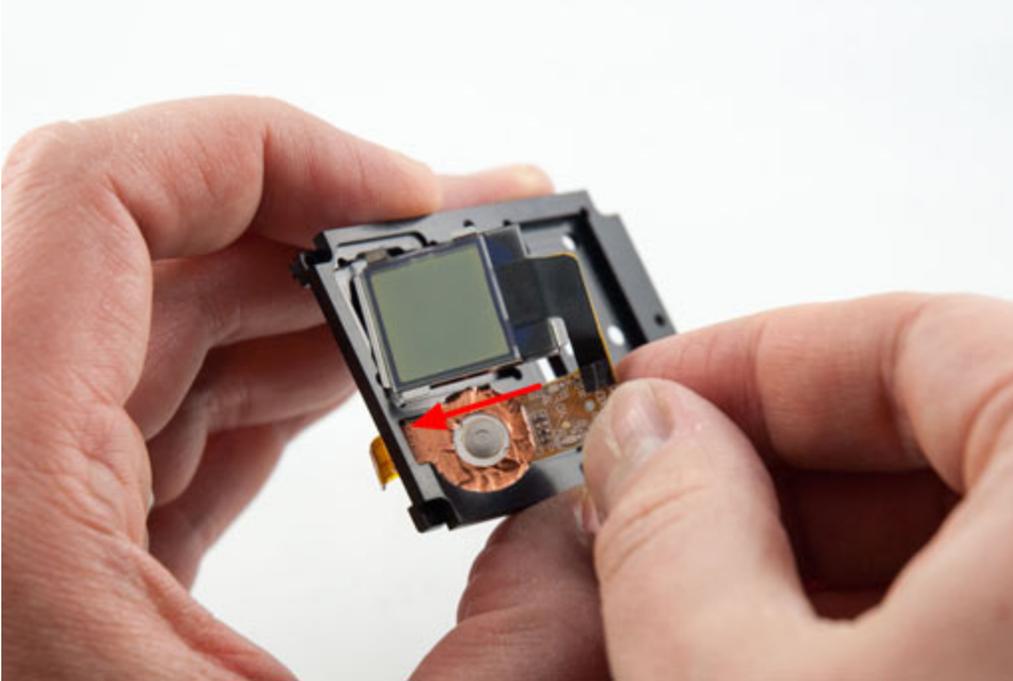
Place the parts into the Ribcage faceplate. Use a screwdriver to push in the LED covers. Work them in until seated correctly by applying pressure to the edges.



2-3 Attach LCD/Button Strip

Video: <http://youtu.be/Tz3vMLKMPJE?t=9m55s>

Insert the LCD/ button strip into the PCB plate. Be sure to align the button and ribbon as closely as possible to the channel in the plate to ensure a tight fit later on, and to ensure the connector extends out far enough to be reconnected.

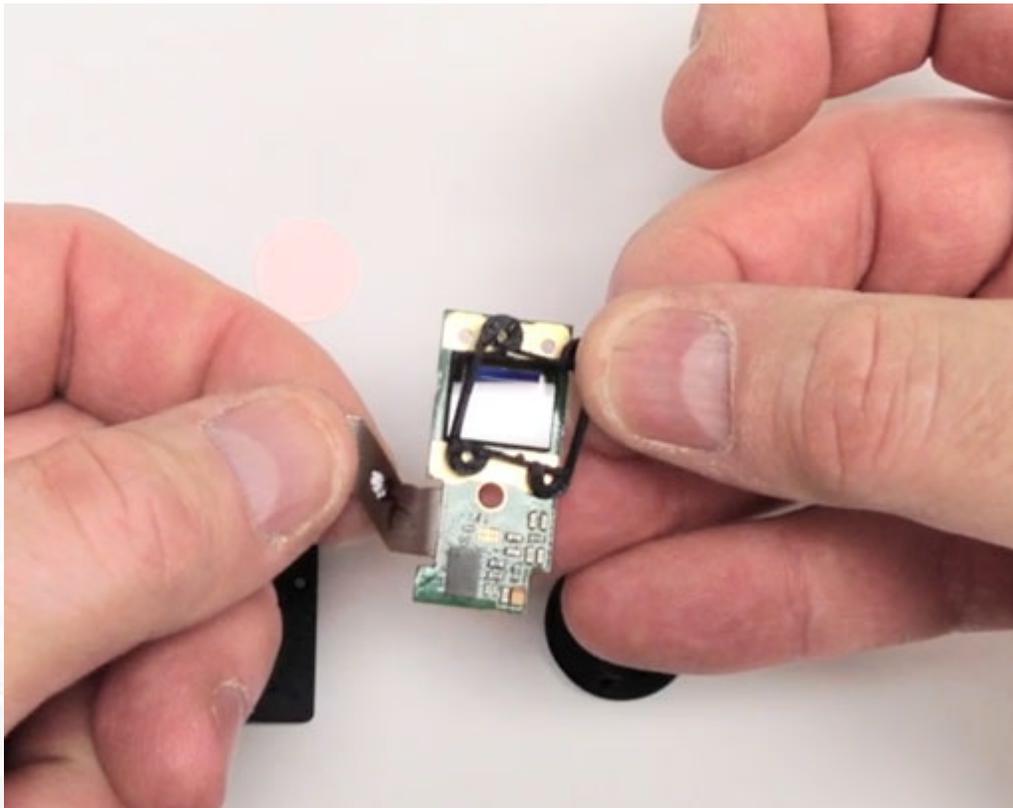


2-4 Attach CMOS Sensor to Cover Plate

Video: <http://youtu.be/Tz3vMLKMPJE?t=10m24s>

(PLEASE READ THIS ENTIRE SECTION BEFORE PROCEEDING)

You will now need the tools and screws provided in the kit. A couple of extra screws are provided so don't be concerned if you have some left over in the end. Take care not to touch the image sensor during the following steps, but if you do it can be cleaned later. Place the plastic standoff over the image sensor.

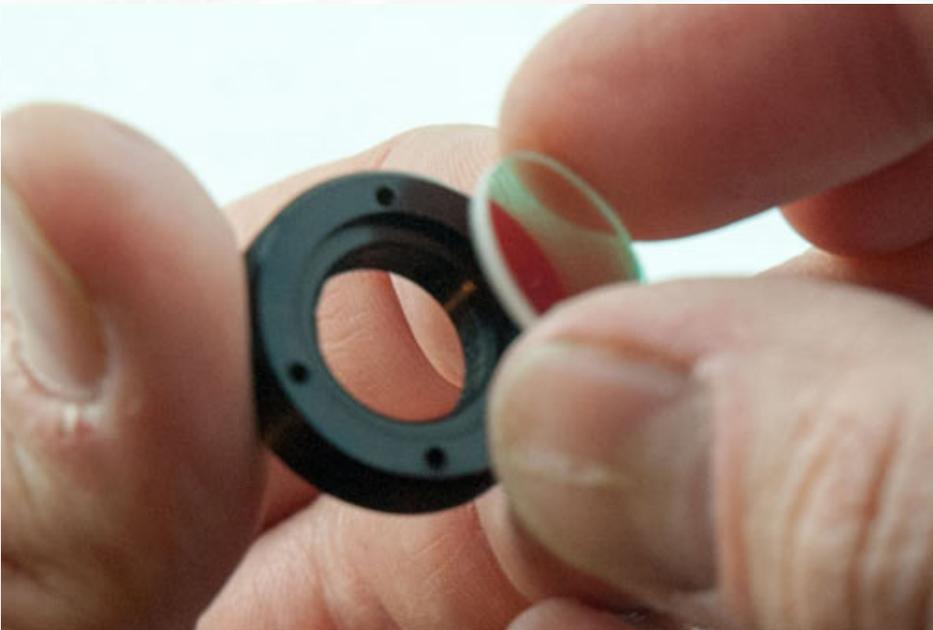


Important Note: As of May 2014 the screw packet contains 4 x ¼" stainless steel Philips screws for mounting the M12 ring. If your kit contains these screws please use them for the following steps.

Screw in four of the ¼" screws provided through the holes in the back of the image sensor board and through the standoff. These are the longest screws in the package. In the latest version of the kit they are stainless steel Philips screws.



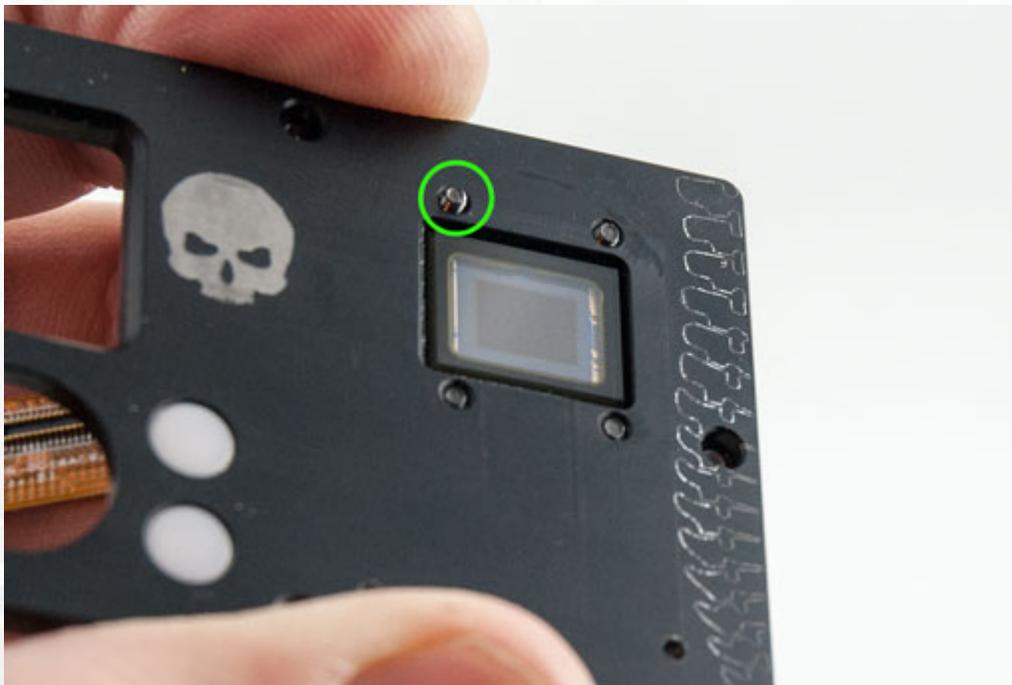
If you wish to permanently install your IR-Cut filter, place it into the back of the M12 ring now before you connect it to the faceplate – again taking care not to add smudges or debris. Make sure the set screw hole is aligned to the top of the camera.



Insert the image sensor with the plastic standoff into the Ribcage cover plate so that the four holes line up correctly.

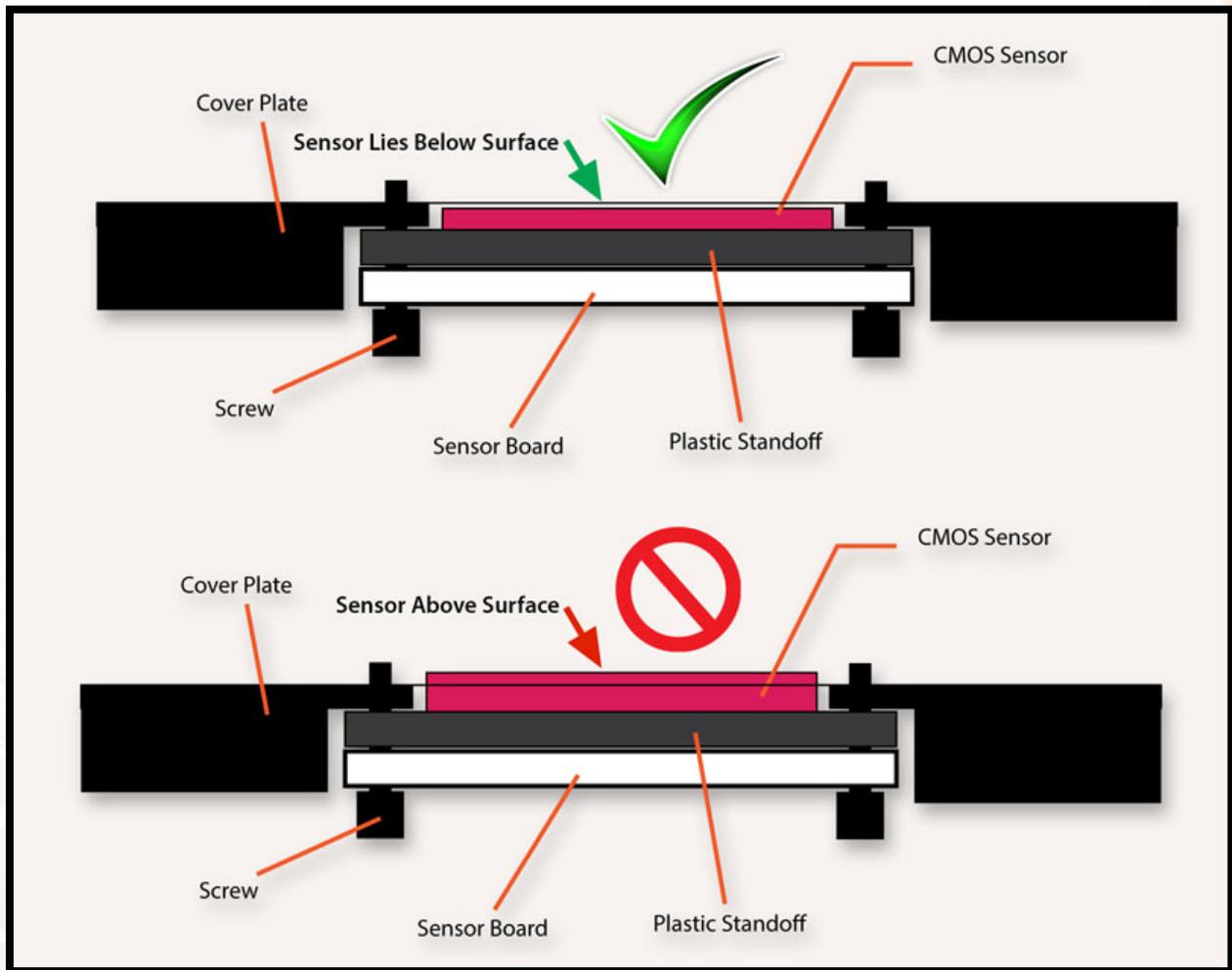


Insure that three of the four screws are flush with the front of the cover plate. The fourth screw should extend beyond the cover plate slightly for attaching the M12 ring.



At this point it's very important to make sure that the CMOS sensor is NOT TOUCHING the aluminum cover plate. Verify that the glass pane of the CMOS sensor lies beneath the top surface of the cover plate. The Ribcage kit is designed so that the CMOS glass on the sensor lies 0.1mm beneath the top surface of the cover plate.

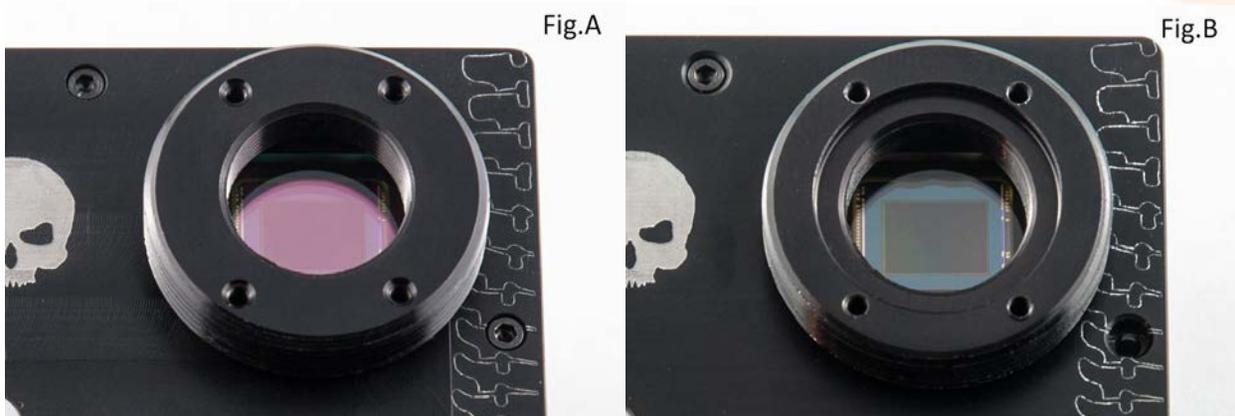
IF THE GLASS OF THE SENSOR DOES NOT LIE BENEATH THE SURFACE OF THE COVER PLATE THAN DO NOT PROCEED AND CONTACT BACK-BONE SUPPORT (support@back-bone.ca).



You may now choose to permanently install your IR cut filter. At this point make sure clean your CMOS sensor if any debris or smudges are visible. Inspect both the IR-Cut filter and sensor carefully to make sure they are crystal clear before permanently installing. Cleaning the sensor after permanently installing the IR-Cut will mean having to partially disassemble your camera.

Permanent IR-Cut Placement

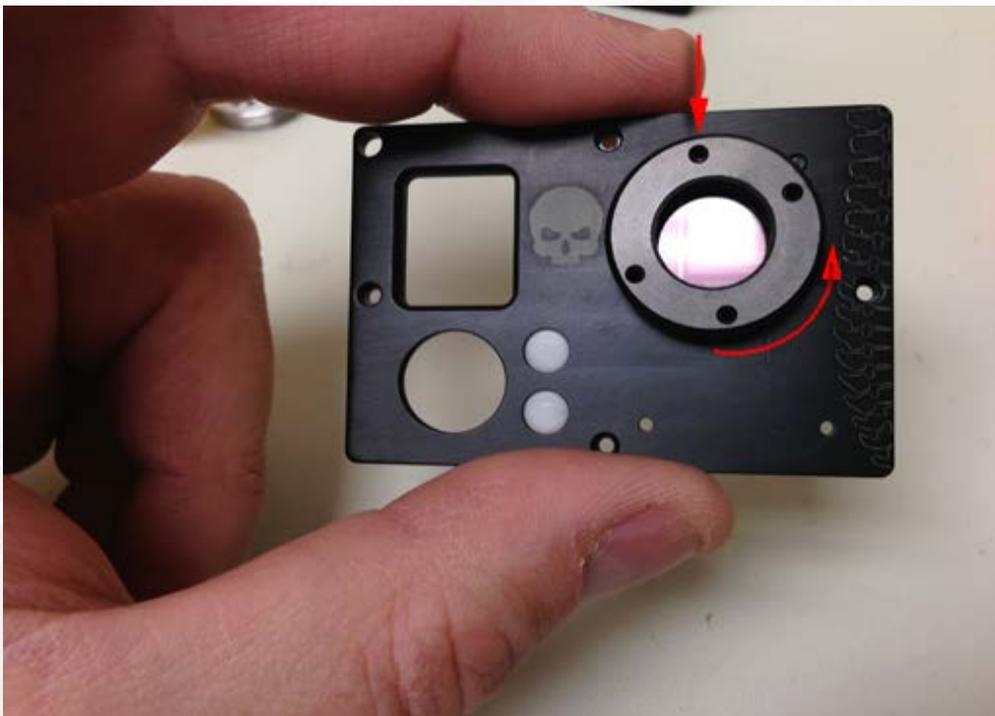
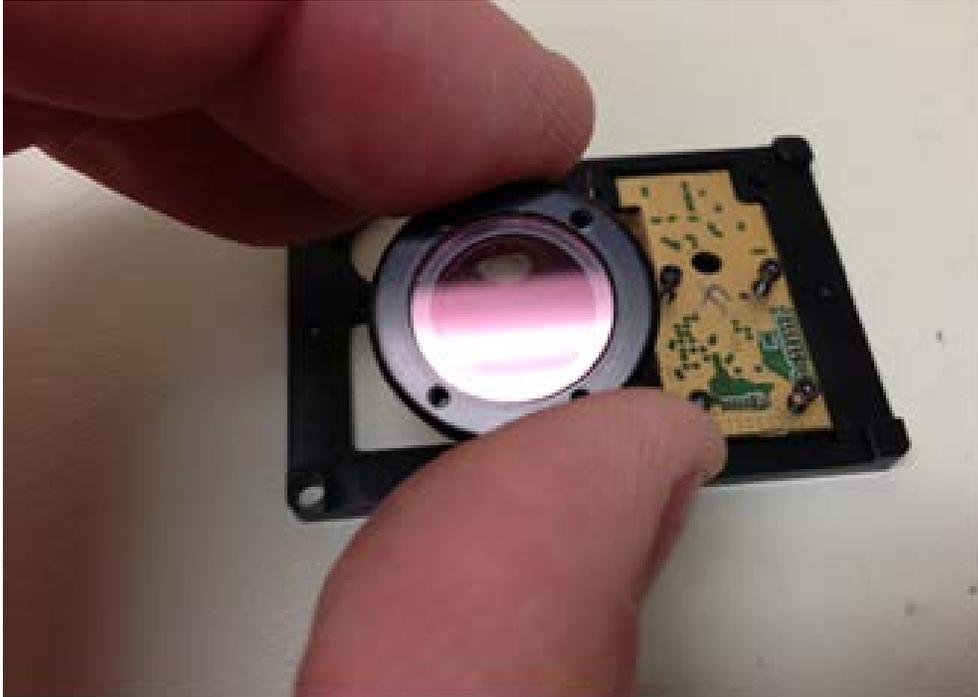
The recommended method to attach the IR-cut filter is towards the rear of the M12-ring i.e. in the closest position to the CMOS sensor (Fig.A). This is the method displayed in the following steps.



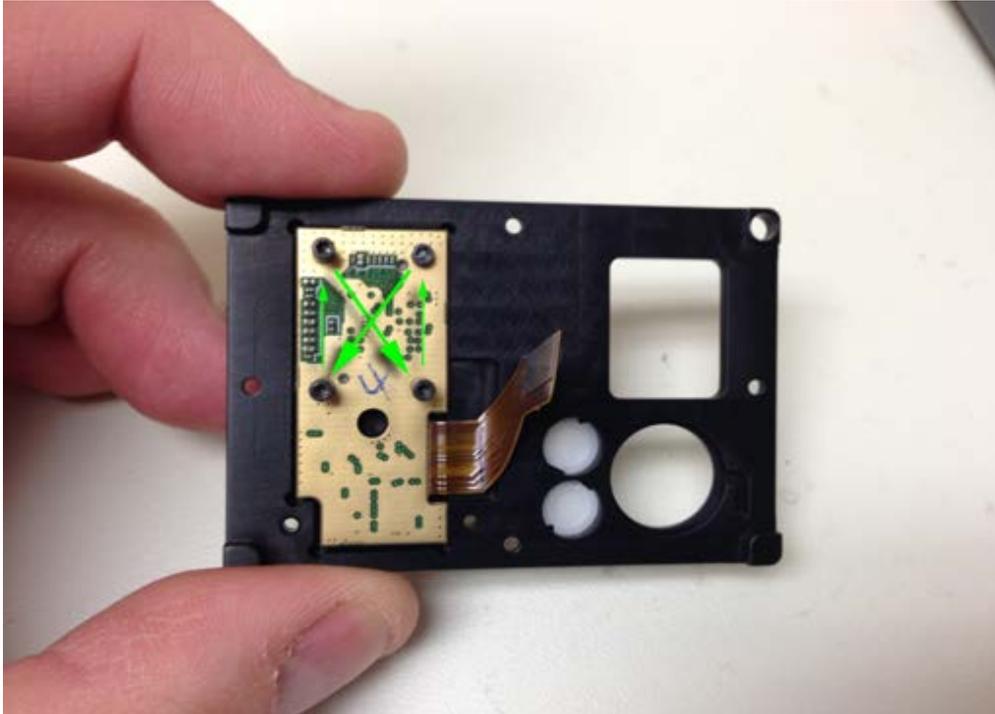
Removable IR-Cut Placement

If you want the IR-cut filter to be removable for night vision, simply turn the ring over so that the filter socket faces forward (Fig. B) and continue following along. We'll install the filter for that configuration later.

Position the M12-ring with its set screw hole towards the top. Screw the first socket screw into the M12-ring, but do not tighten it. With the first screw loosely in position, turn the M-12 ring to align the remaining three holes with the holes in the cover plate.



Lastly, we will gently in a repeating crisscross fashion tighten all 4 screws until the M-12 ring lays flush with the cover plate and the 4 screws are snug ONLY i.e. tighten only to the point of contact. As you tighten the four screws slowly in the crisscross fashion give the assembly a little shake and listen for the IR-cut lens moving inside. This indicates that the image sensor is safe because it is not making contact with the filter



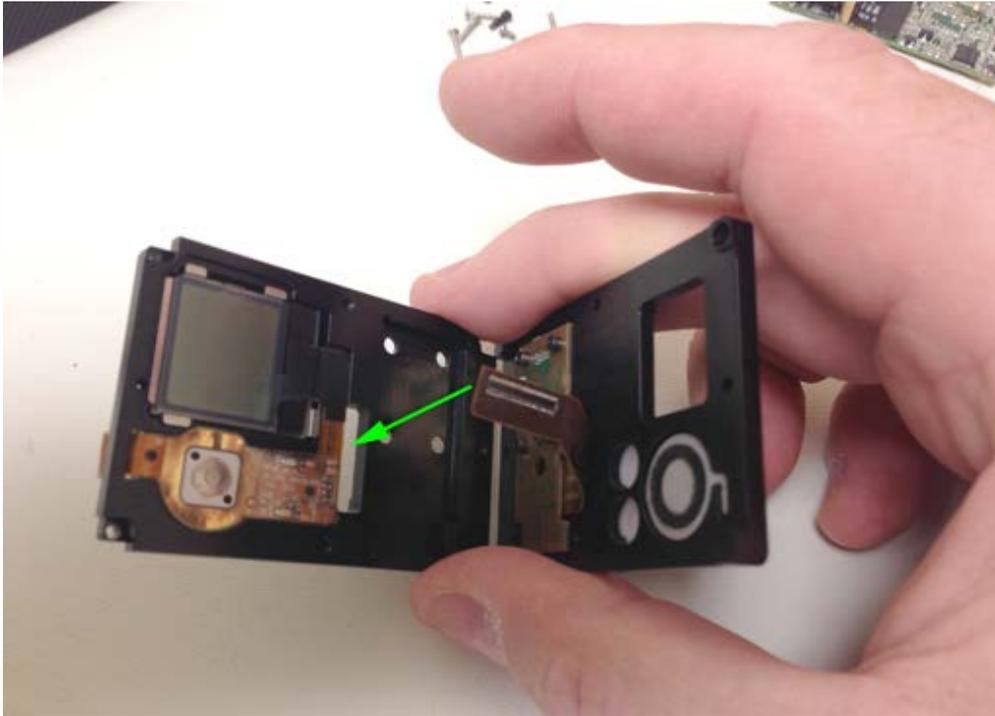
This small gap can also be verified by sliding a tiny piece of paper between the M12-ring and the IR-cut filter.



2-5 Attach the Cover Plate to the PCB Plate.

Video: <http://youtu.be/Tz3vMLKMPJE?t=14m41s>

Attach the cover plate to the PCB plate. Carefully thread the flexible connector through the opening in the PCB plate.



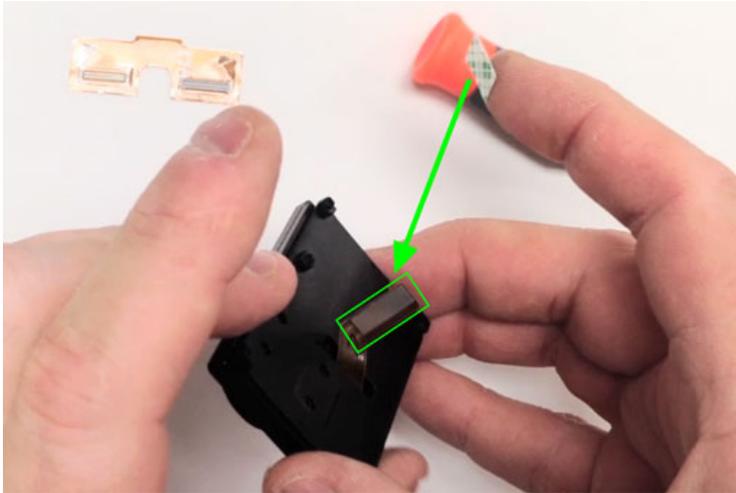
Once together connect them with two of the 1/8" screws provided. *Note: when all the pieces are properly aligned the assembly fits together easily. Never force any of the components, instead check that they are seated properly and try again. The newest version of the kit contains 3/16" screws for this step.*



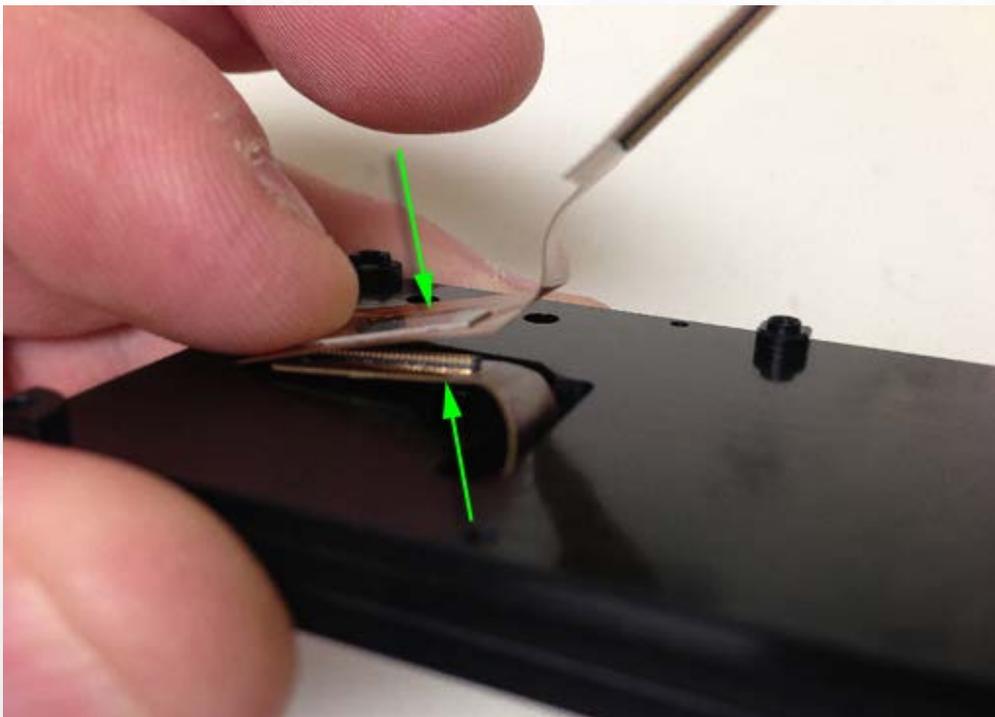
2-6 Connect flexible PCB jumper to PCB plate.

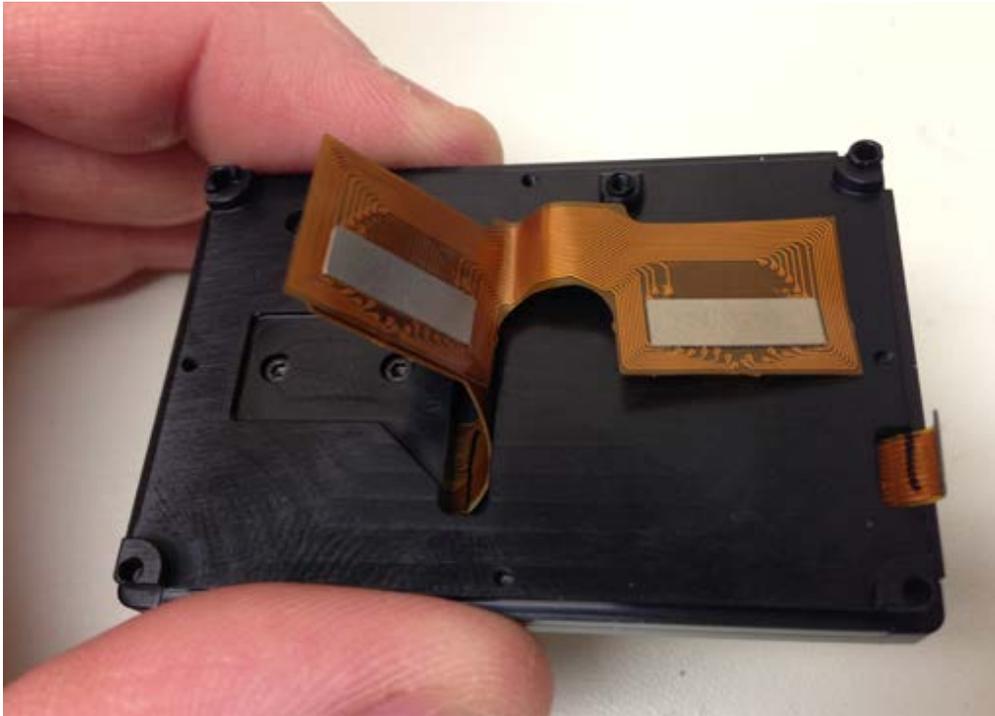
Video: <http://youtu.be/Tz3vMLKMPJE?t=15m16s>

Optional - If you wish you can choose to place a small piece of double-sided tape on the back of the flexible 50 pin connector and then tape it down to the groove of the PCB plate after joining the connectors. Be sure to use only thin tape, not any kind that has a thickness made of rubber or foam.



Next we'll connect the flexible jumper. Be very careful to align the tiny 50 pin connectors together before exerting a small amount of pressure. **FORCING THE CONNECTORS TOGETHER WILL DAMAGE THEM ESPECIALLY IF THEY ARE NOT PROPERLY SEATED.**

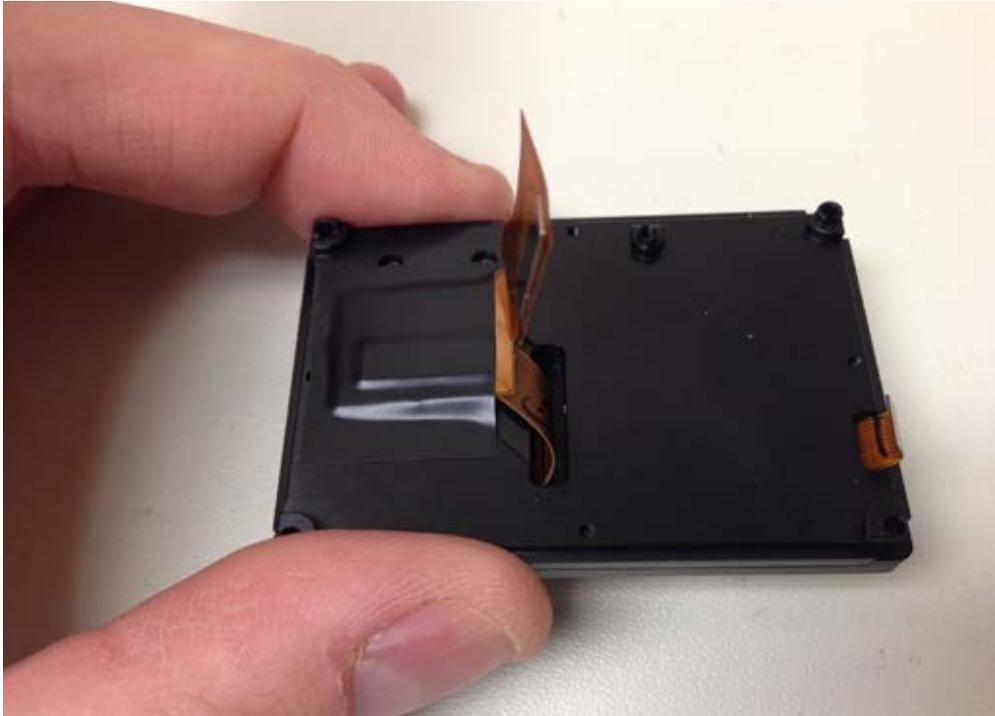




Place a small piece of electrical tape over top the metal stiffener on the flexible PCB. When taping down the ribbon try to move it as far to the top of the groove as it will comfortably go. The tape will help isolate the metal stiffener from the bottom side of the PCB board that we will be attaching next.

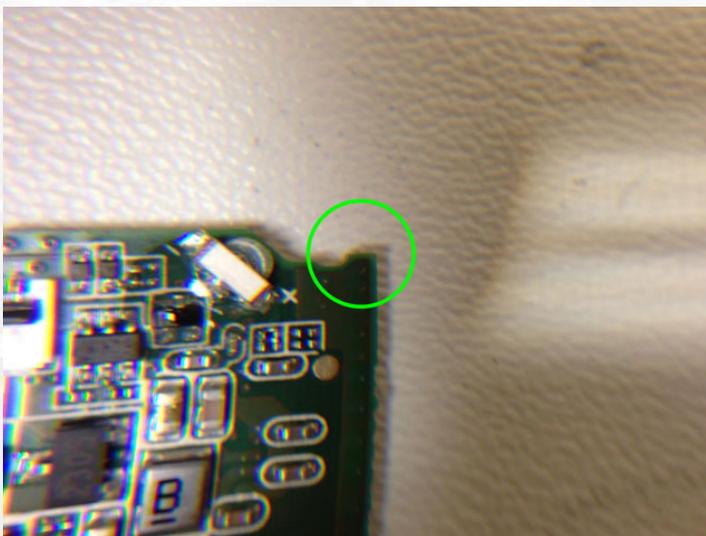


Bend the flexible PCB 90 degrees. This will make attaching the PCB board in the next step easier.



A Note for Hero3+ Installations:

There's a small variation in the main boards of the Hero3+ which now have a small tab in the upper right corner.

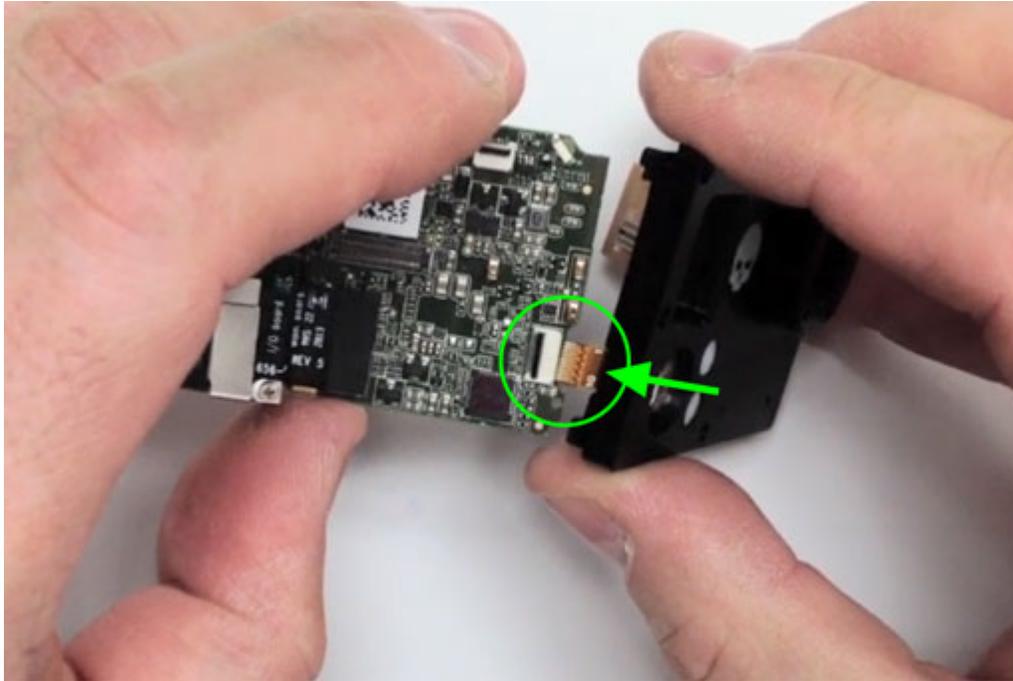


We recommend taking a small file and shaving off about 0.5mm from the tab.



This will insure that the main board sits correctly in the bracket. This step is not required for users of the Hero3.

Attached the small ribbon connector and then carefully lay the PCB board on the PCB plate making sure to align the mounting hole.



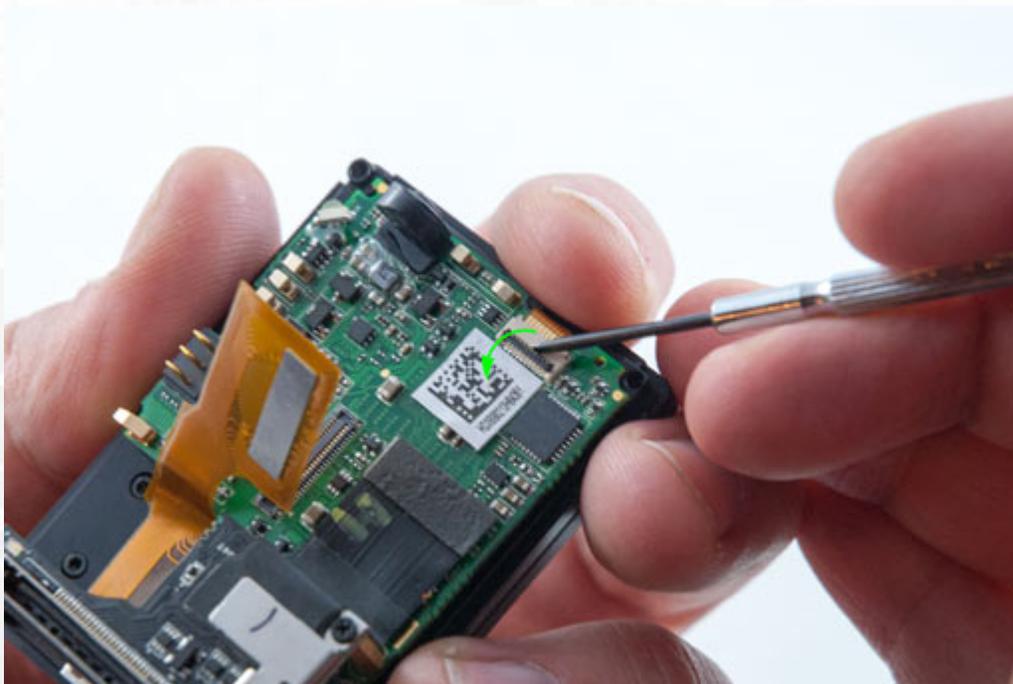
Carefully move the flexible PCB jumper into the empty area where the wide angle lens assembly resided and match the through hole of the PCB board with the mount on the PCB plate. *Note: part of the flexible connector should remain tucked under the board slightly – do not try to pull it out and over as this can cause tearing or damage.*



Attach the board with the small metallic 1/8" Philips screw provided.



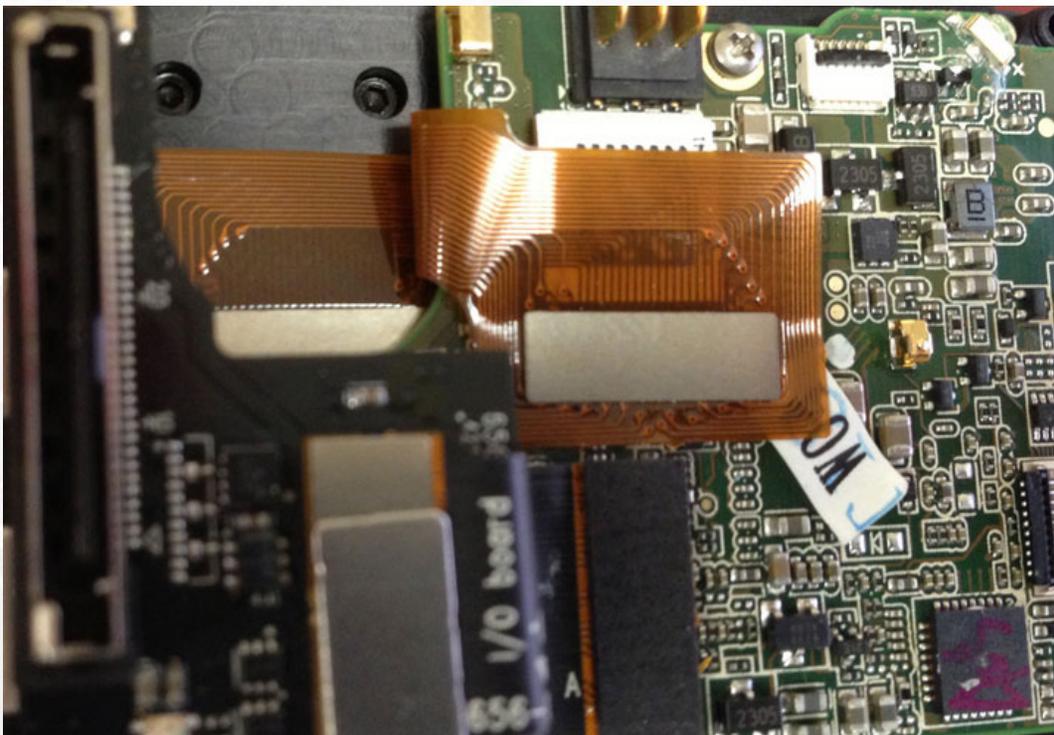
Flip down the black plastic locking mechanism to hold the LCD connector in place.



Connect the flexible PCB jumper to the PCM board taking care to align the connectors prior to exerting any pressure to seat them together. They should click together easily when properly aligned.



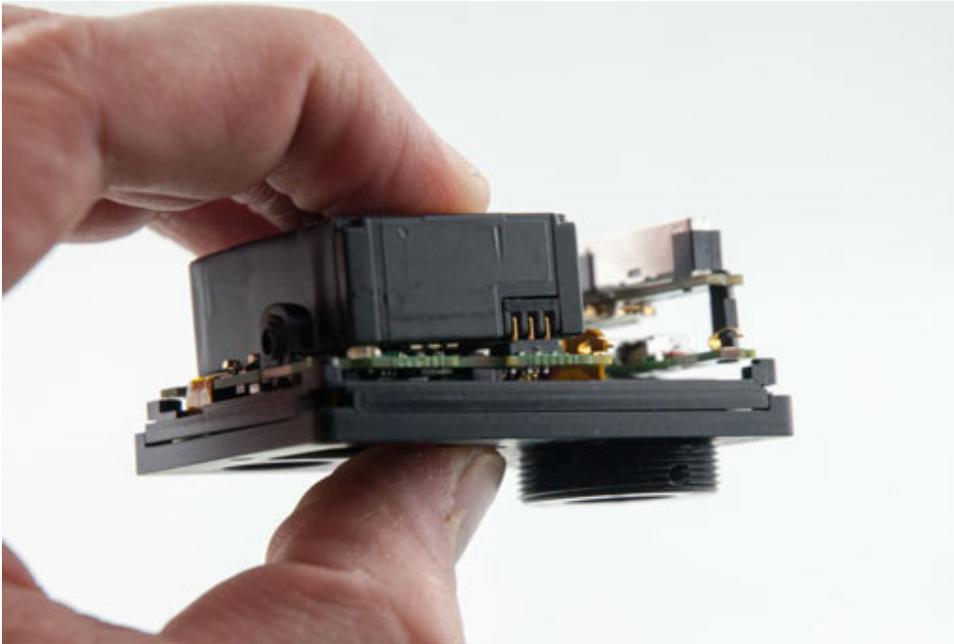
Part of the ribbon should remain tucked under the board slightly and bent over to form an 'S' shape as pictured.



2-7 Functionality Test

Video: <http://youtu.be/Tz3vMLKMPJE?t=18m17s>

Now it's time for a quick test. Take the battery and slide it onto the contacts located on the back of the camera. Hold the battery in place and press the power button. If the camera powers on and you are able to switch modes everything is good! If the camera doesn't power on, or you can't change modes ensure your battery is charged, double check your connections and try again.



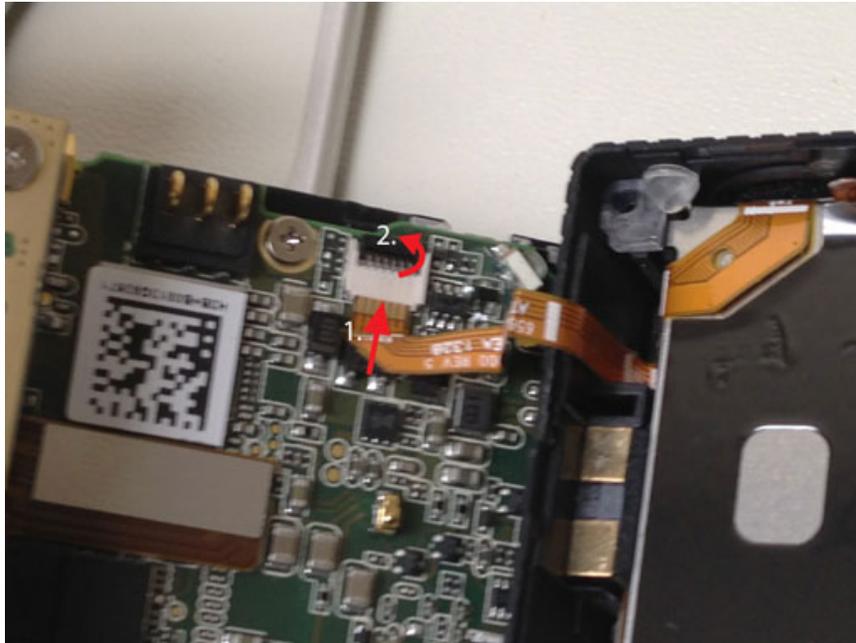
2-8 Put Ribcage Assembly Back Into Housing

Video: <http://youtu.be/Tz3vMLKMPJE?t=18m49s>

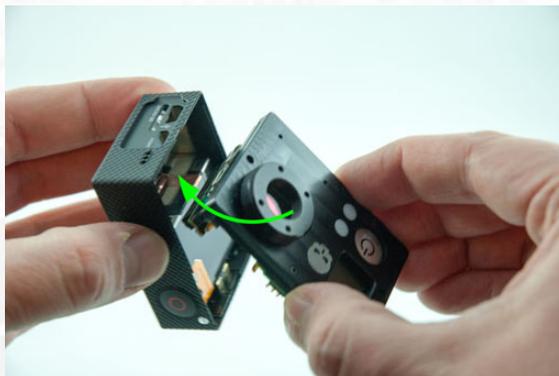
Now we'll place the assembly back into the housing. Add a small piece of electrical tape to the upper side of the flexible PCB jumper to help isolate the jumper from the housing.



If you have a Hero3+ make sure you re-attach the small ribbon connected to the housing. Re-insert the ribbon into the connection socket as pictured and click down the black locking mechanism to hold it in place. This is not required for Hero3.



Take the Ribcage assembly and angle it back into the housing ensuring the HDMI and USB ports properly mate with their openings and the assembly is fully inserted.



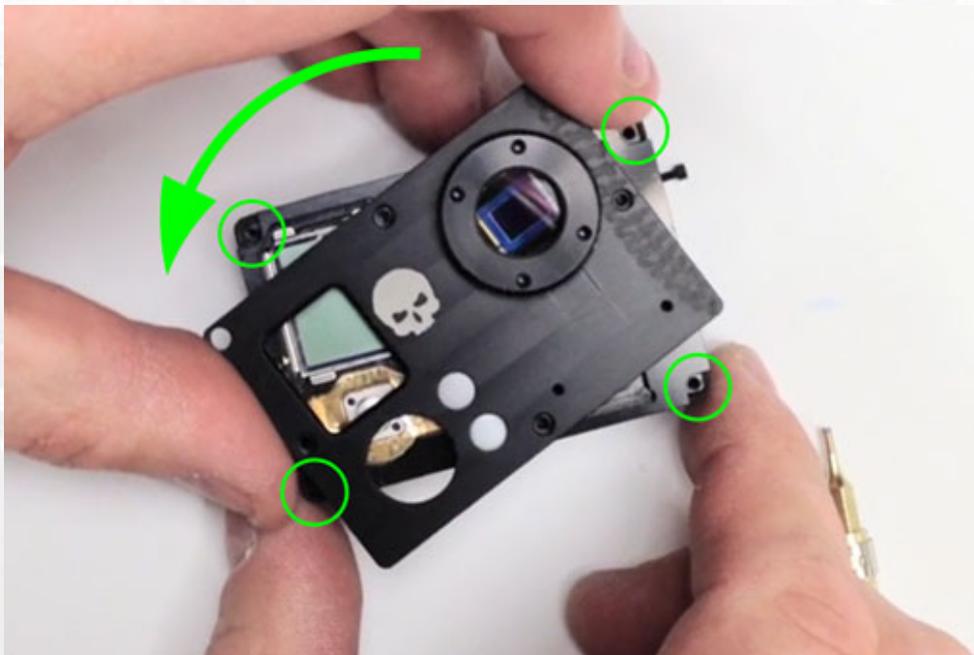
2-9 Release Cover Plate Screws

Video: <http://youtu.be/Tz3vMLKMPJE?t=19m45s>

Release the two screws holding on the new cover plate.



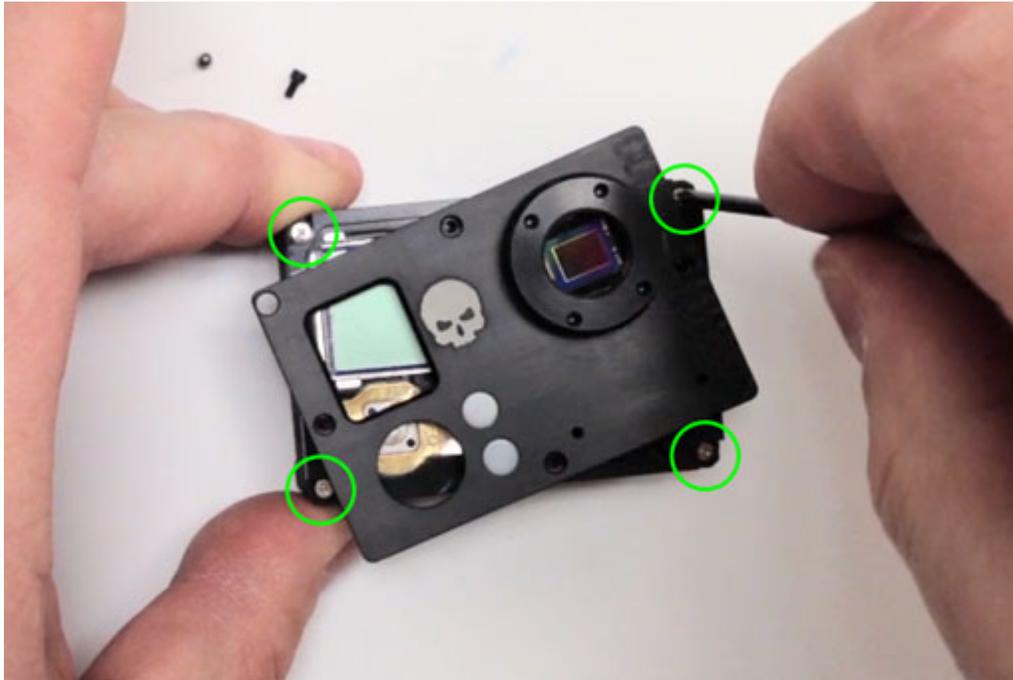
Separate the plate slightly and rotate it about ten degrees to reveal the four screw holes located in the corners.



2-10 Insert Original Corner Screws

Video: <http://youtu.be/Tz3vMLKMPJE?t=20m13s>

Insert the original four corner fastening screws. Tighten them until snug.



2-11 Screw on Cover Plate

Video: <http://youtu.be/Tz3vMLKMPJE?t=20m37s>

Next turn the unit over and place the power button in position within the cover plate.



Guide it in with your screw driver if required. Click the cover plate back into place.



Now fasten the faceplate with the four 1/8" screws provided. Loosely fit all four screws before tightening all the way. Do not over tighten. A snug fit is all that's required. As previously mentioned the newest version of the kit (May 2014) only contains slightly longer 3/16" screws for this step.



2-12 Insert Set Screw Into M12 Ring

Video: <http://youtu.be/Tz3vMLKMPJE?t=21m14s>

If you plan to use M12 lenses similar to the original GoPro lens, insert one of the tiny set screws into the top of the M12 ring using the small L-key provided.



2-13 Attach CS-Mount Ring

Video: <http://youtu.be/Tz3vMLKMPJE?t=21m44s>

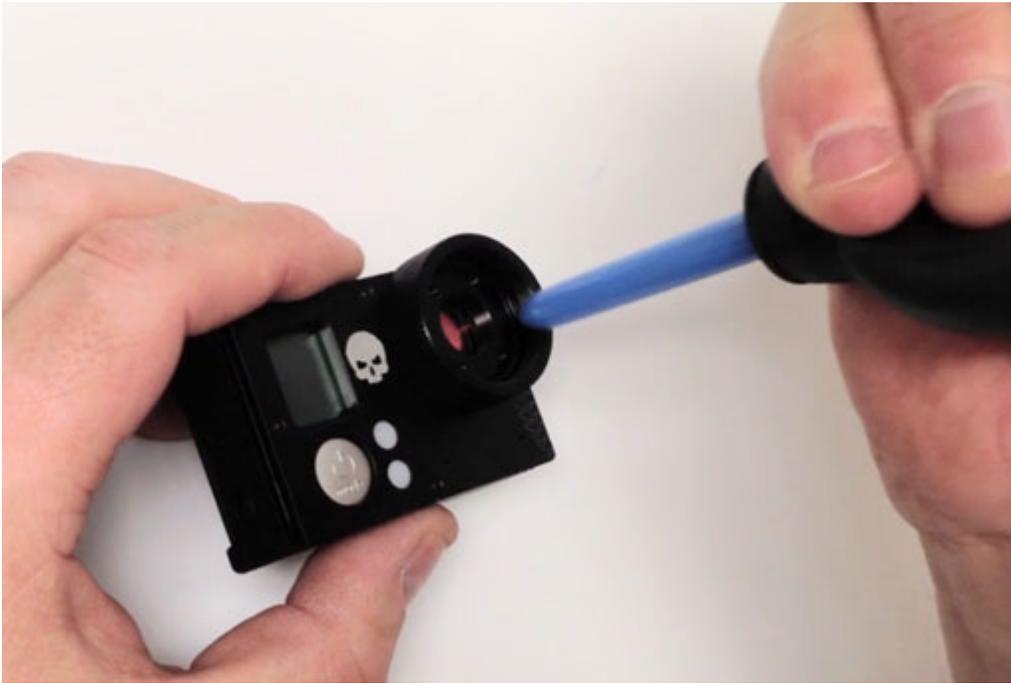
Screw the CS-Mount ring into place over the M12 ring.



Insert the remaining tiny set screw into the CS ring and tighten until snug using the provided Allen key.



Use a puffer to remove any debris from the assembly.



2-14 Re-attach Battery and Accessories

Video: <http://youtu.be/Tz3vMLKMPJE?t=22m56s>

Re-attach the battery and accessories.



2-15 Install IR Cut Filter and Holder

Video: <http://youtu.be/Tz3vMLKMPJE?t=23m27s>

If you've chosen to have a removable IR-cut filter, remove the CS-Mount ring and thread the plastic IR-cut holder into the front until it drops into place at the bottom. The plastic holder is designed to have a snug fit, so please take your time and don't force the part.



Drop the IR cut filter into the front of the M12 ring and screw the CS-Mount ring back into position on top.



2-16 Attach C-Mount Ring

Video: <http://youtu.be/Tz3vMLKMPJE?t=23m51s>

In order to attach C-Mount lenses attach the 5mm C-Mount spacer ring.



2-17 Attach Tripod Mount

Video: <http://youtu.be/Tz3vMLKMPJE?t=24m8s>

Attach the Ribcage tripod plate using two 3/16" screws provided. Loosely fit both screws before tightening all the way. Do not over tighten. If the screws feel tight, back them off slightly and make sure the threads are properly aligned.



2-19 Done!

Video: <http://youtu.be/Tz3vMLKMPJE?t=24m50s>

You're all done! Go out and enjoy your new camera and have fun experimenting with different lenses!

