



CKE-M305-001


Unmanned Aerial Vehicle MultiRotor



Helpful instructional videos available at: mindsieducation.com


MINDS-i® PRODUCT SAFETY INFORMATION

When safety precautions are followed, your MINDS-i® system will provide years of enjoyment. Use care and good sense at all times when operating this product. Failure to use your system in a safe, sensible manner can result in injury or damage to property. You and you alone must insure that the instructions are carefully followed and all safety precautions are obeyed.

- Water can cause the electronics to short out and can cause permanent damage.
- Always turn on the transmitter before turning on the receiver.
- Fully extend the transmitter antenna before operating your vehicle.
- Before turning on your radio system, check to make sure that no one else is running on the same frequency.
-  **CHOKING HAZARD:** Do not allow children under age 3 or any individuals who have a tendency to place objects in their mouths to play with any part of the MINDS-i system, including, but not limited to: connectors, pieces, electronics, radio transmitters, wheels, tires. The system contains small parts which could accidentally be swallowed and cause suffocation.
- When the system is powered and/or in motion, keep fingers, face, tools, loose clothing, hair, and all other body parts away from gears, wheels, etc. Do not wear gloves while operating machinery. Even plastic parts can pinch, cut, or crush.
- The transmitter's antenna could also cause injury if played with violently or pointed towards someone's face.
- Never operate your MINDS-i® system on streets or in any areas where full-size vehicles are.
- Do not pick up your MINDS-i® system when it is in motion.
- Never charge, run or store your MINDS-i® system in a location subject to high temperatures, low temperatures or high humidity.

Do not store in direct sunlight.

- To avoid electronic malfunction, do not allow the vehicle to become wet. Short circuits will produce a very strong electrical current. Should your MINDS-i® system become wet, stop using it immediately.

-  **WARNING! Electrocutation Hazard.** Do not use the materials provided for other than its intended purpose.
- Do not put it into fire.
- Always use recommended batteries. If improper batteries are used, they may become hot, leak and may rupture.
- Do not attempt to recharge non-rechargeable batteries.
- Only batteries of the same equivalent type as recommended are to be used. Do not mix old and new batteries.
- Exhausted batteries are to be removed from the system and replaced with new ones. Recycle all used batteries.
- Do not lick batteries. If battery appears to be leaking or has a crystalline deposit on the outside, dispose of it immediately (wear gloves when handling, preferably nitrile or other non-reactive material).
- Do not run a wire between battery terminals, as wire will get very hot, can be irreparably damaged or explode.
- Make sure the batteries are installed with the correct polarity as shown. Do not disassemble your batteries. Never allow them to become hot or to burn. To avoid short-circuits, avoid getting them wet. Do not short circuit batteries.
- If liquid from inside the batteries contacts your skin or clothes, wash them with water. If leaked battery fluid gets into your eyes, flush them immediately with cool water and seek medical attention. Do not rub eyes.
- Always wear safety glasses to protect your eyes. Note that normal glasses, while usually made of impact-resistant plastic, will not afford sufficient protection from shrapnel or flying debris.
- Always wear close-toed shoes to protect your feet from heavy or sharp objects, which might be dropped.
- If you have long hair, keep it tied back or under a hat to avoid it becoming caught in moving parts.
- The MINDS-i® system contains small parts. Do not ingest. Do not insert into any orifice (e.g. nostrils, ears, etc).
- The system contains metal parts. Cutting or bending can cause parts to break; resulting in sharp edges which can cut skin.
- Battery disposal. Do not throw batteries into the trash, especially rechargeable batteries. Contact your local waste disposal office for information on battery disposal. Batteries should be stored as directed by your local hazardous materials disposal office until pickup (usually in a hard sided waterproof, non-conductive container, e.g. a plastic bucket).



WARNING! IMPORTANT! RESPONSIBLE ADULT SUPERVISION IS REQUIRED FOR CHILDREN UNDER THE AGE OF 14. THIS PRODUCT IS NOT DESIGNED FOR UNSUPERVISED USE BY CHILDREN YOUNGER THAN 14 YEARS OLD.

All pictures descriptions and specifications found in this instruction manual are subject to change without notice.

MINDS-i® maintains no responsibility for inadvertent errors in this manual. Visit mindsieducation.com for the latest updates and information.

MINDS-i® is a high-performance Construction/RC/Robotics System, which is NOT intended for use on the public roads or congested areas where its operation may conflict with or disrupt pedestrian or vehicular traffic. Read all enclosed information before operating. Fully illustrated, step-by-step instructions describe adjustment, operation, and required maintenance procedures. MINDS-i® should not be operated in a crowd, or without adequate space. In an effort to continually upgrade our products, MINDS-i® reserves the right to make improvements and modifications to this system, which may not be reflected in the photographs and specifications printed on this box. PROPOSITION 65 WARNING: This product contains chemicals known to the State of California to cause cancer and/or birth defects or other reproductive harm.

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MINDS-i® is Designed and Manufactured in the United States
Some components are manufactured in China and the Philippines.

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USA



UAV MULTIROTOR

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CONNECTOR ASSEMBLY AND USAGE

HELPFUL INSTRUCTIONAL VIDEOS AVAILABLE AT: mindsieducation.com



1.5-LOCK



2-LOCK



3-LOCK



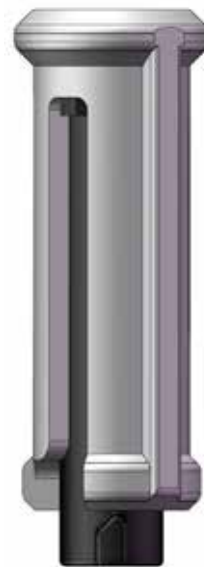
PANEL-LOCK



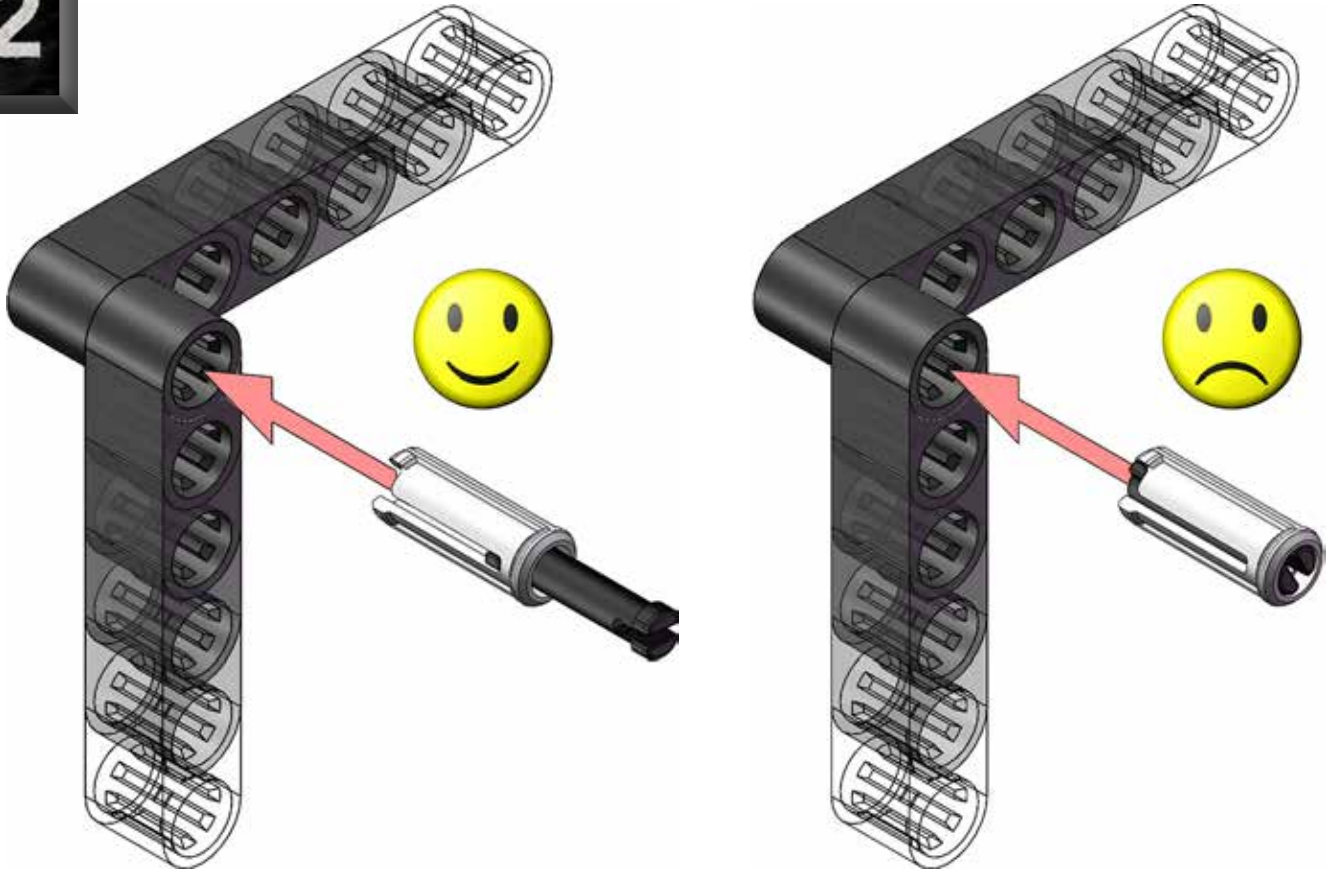
2-ROTATE



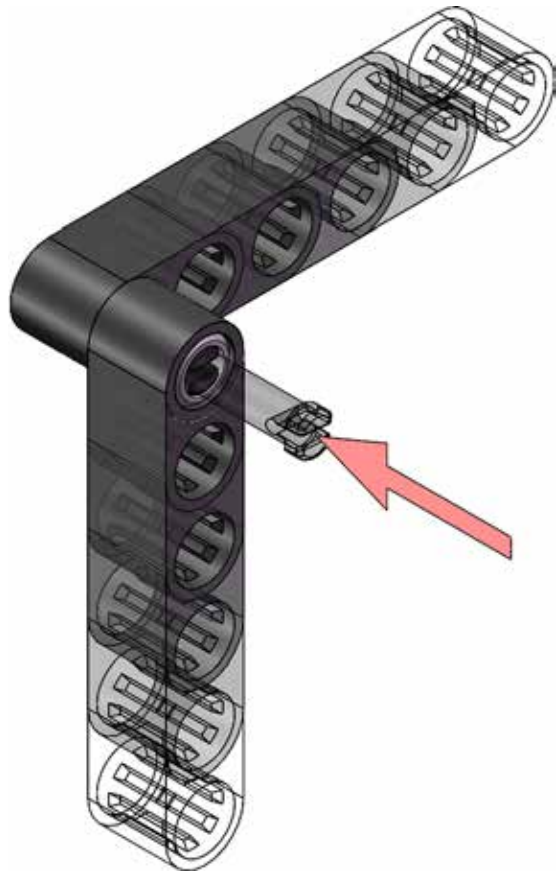
3-ROTATE



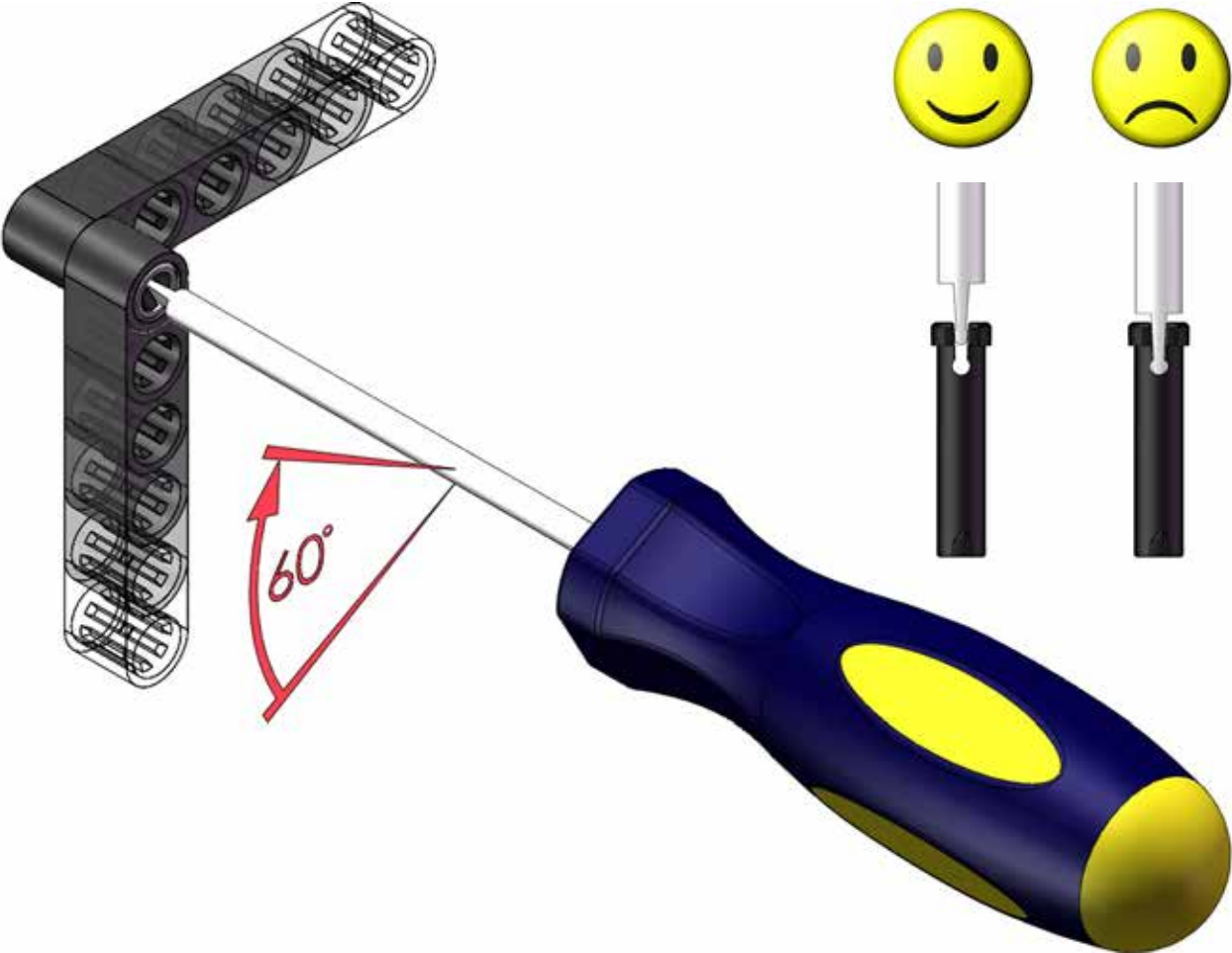
02



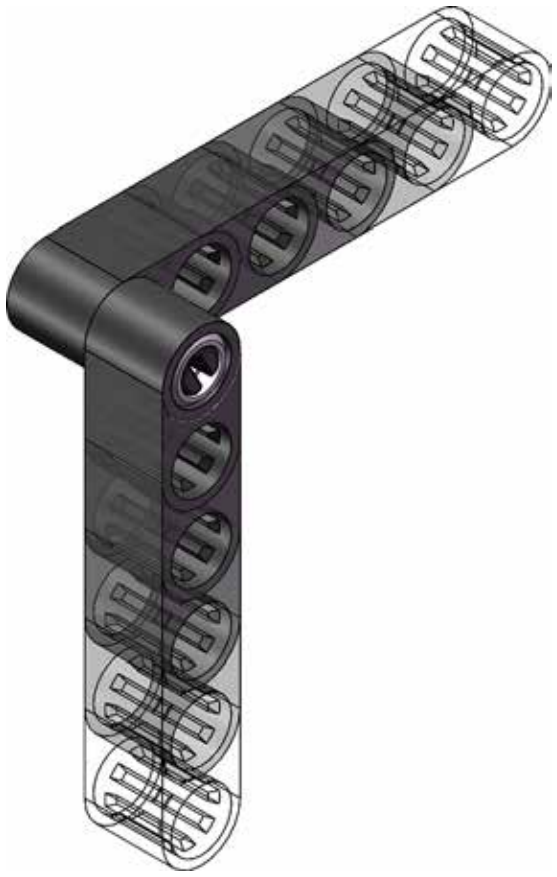
03



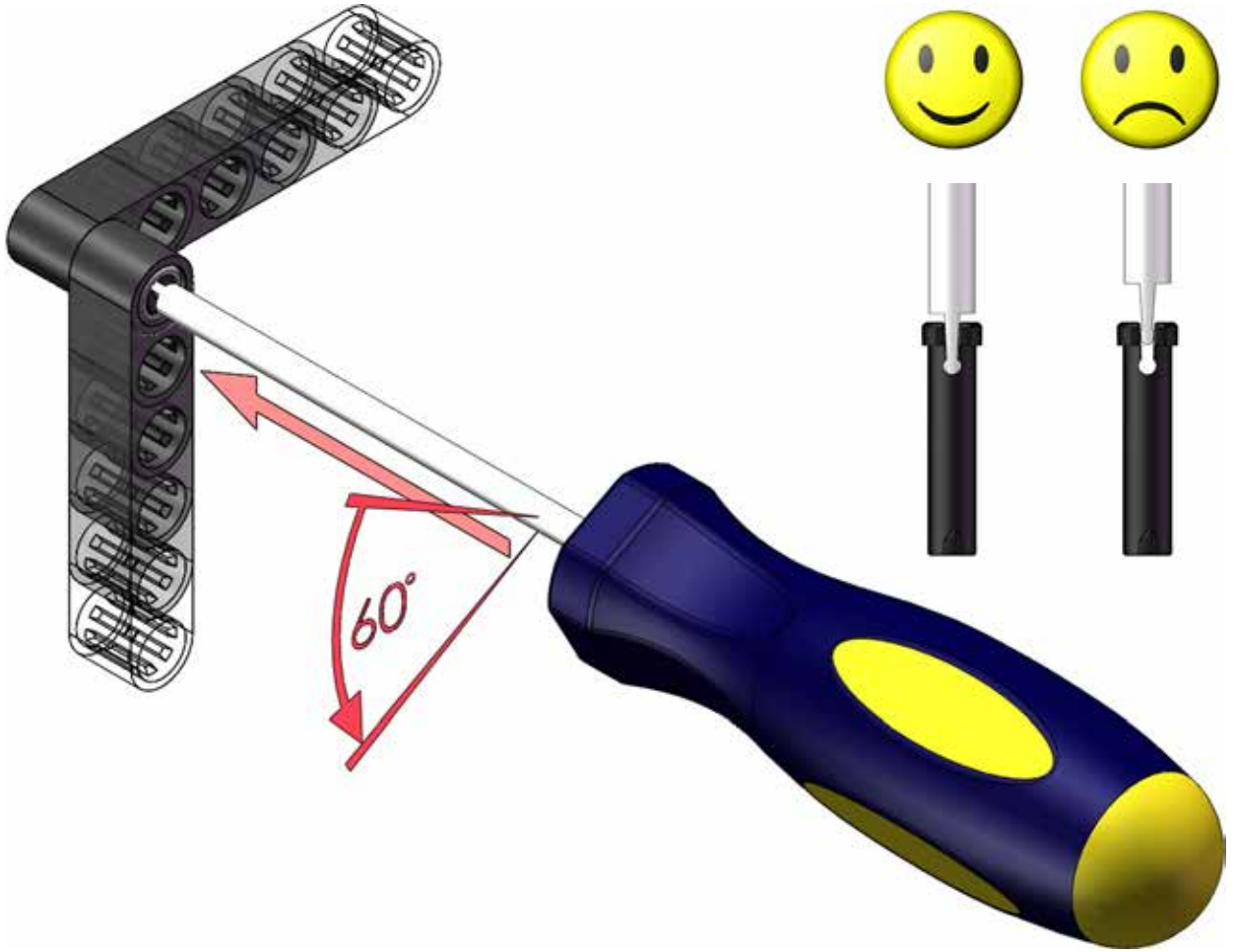
04



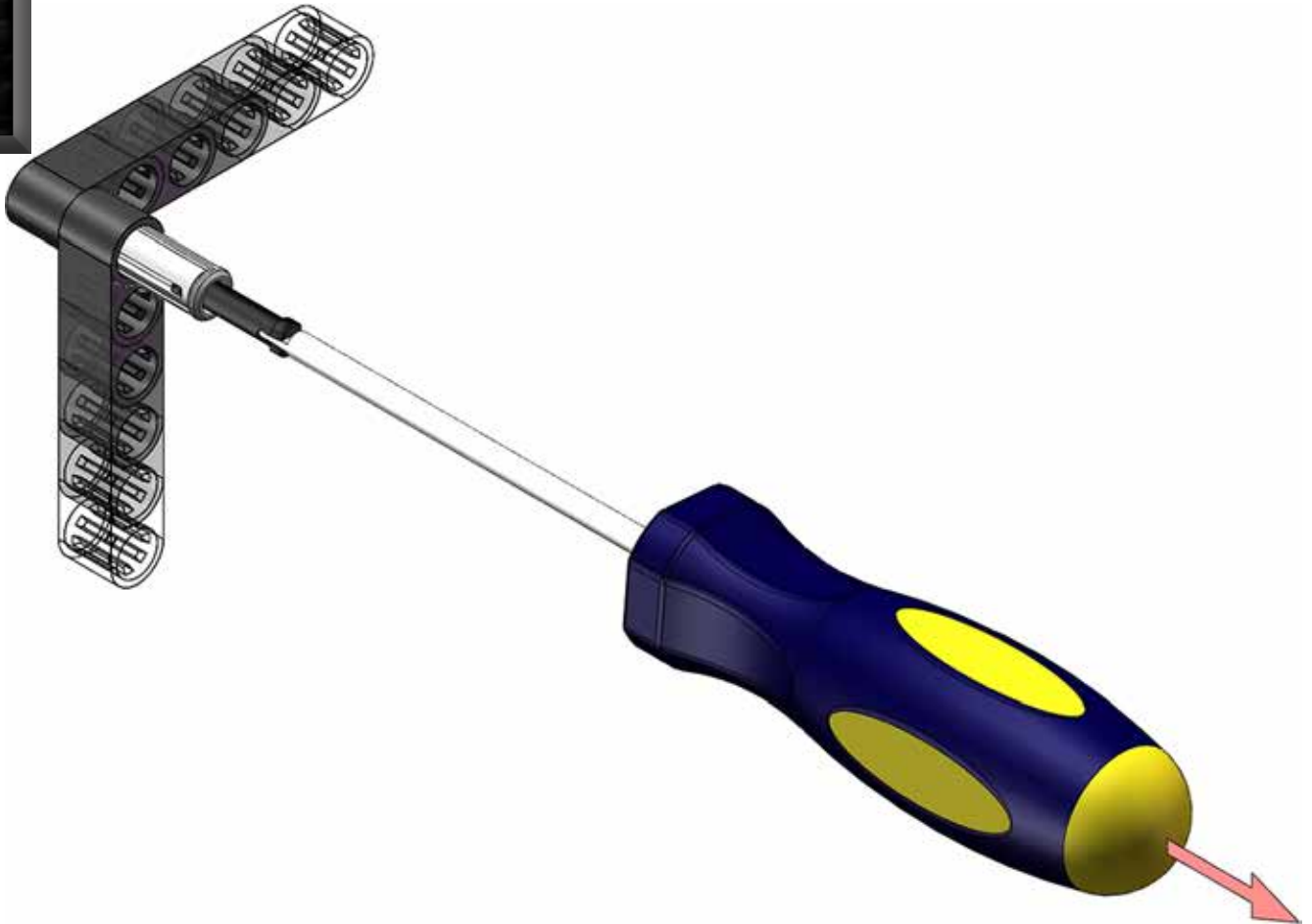
05



06



07



UAV Airframe Build

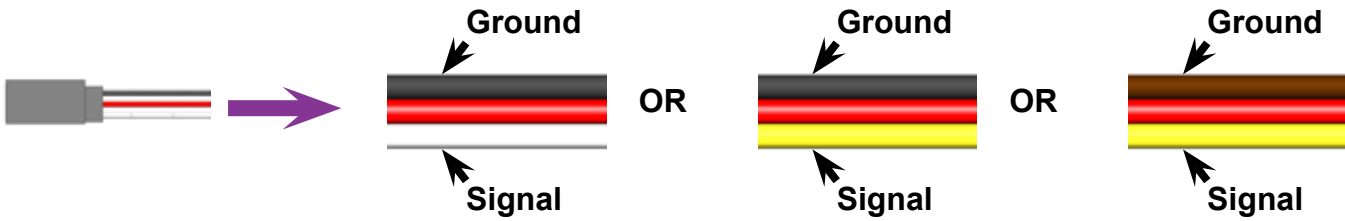


PART IDENTIFICATION REFERENCE

Due to variance in manufacture some parts may differ in shape and color from those pictured in this manual.

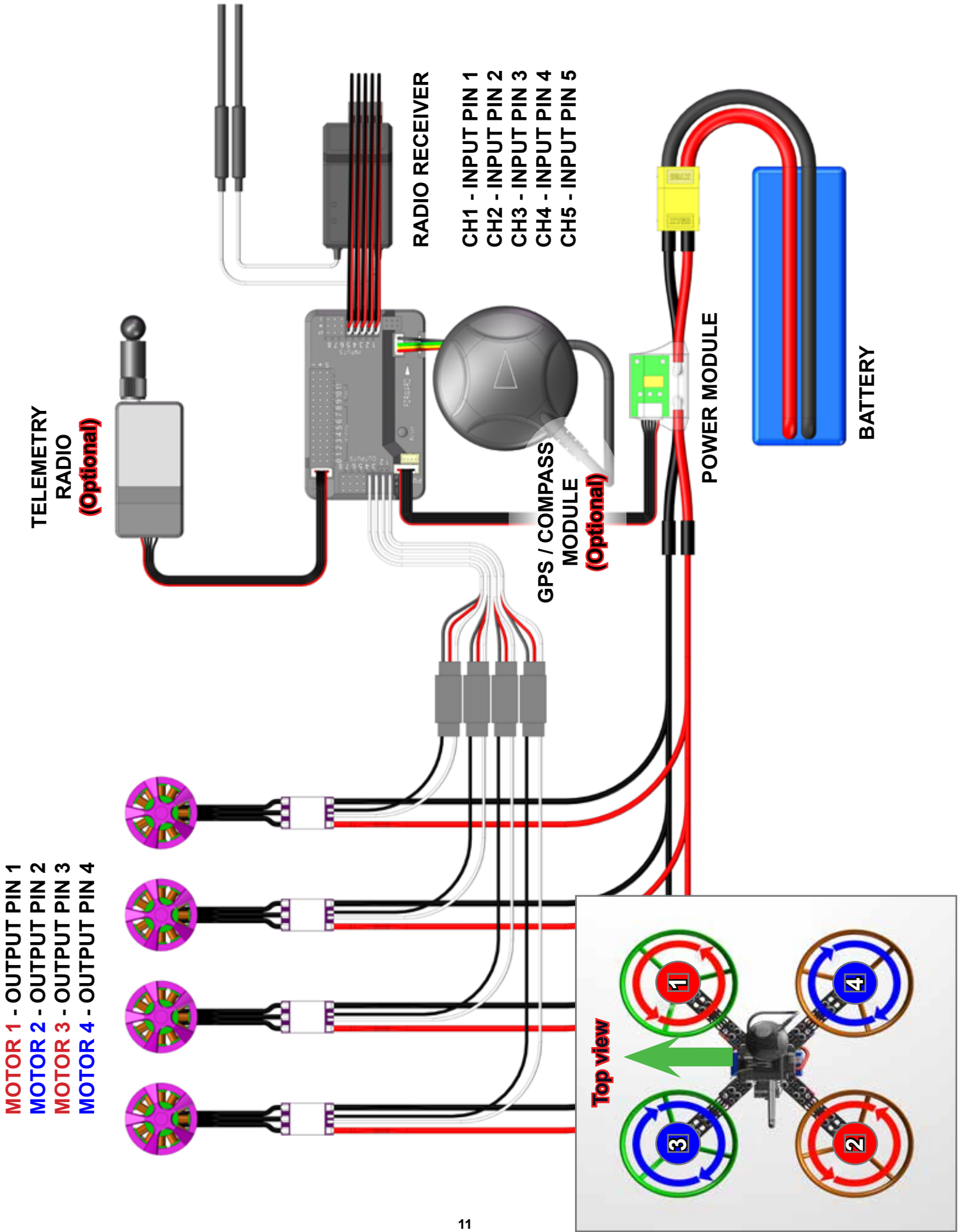
WIRES

For a 2 or 3 wire plug the lightest wire is the signal and the darkest wire is the ground. Colors may NOT match those pictured in the diagrams. Possible variations include:



WIRING GUIDE FOR ELECTRONICS

USE FOR STEPS: 07-09 & 17 - 21



01

x1
5" DUCT



x1
2205 MOTOR MOUNT



x4
M3x8mm SCREW



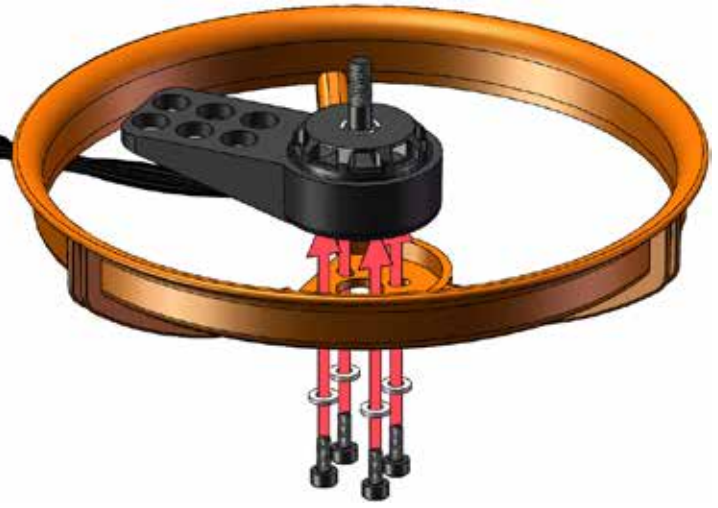
x4
#4 WASHER



x1
CLOCKWISE MOTOR AND ESC



CLOCKWISE (CW) #4



02

x1
5" DUCT



x1
2205 MOTOR MOUNT



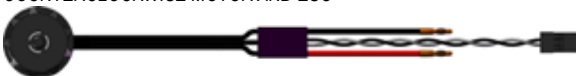
x4
M3x8mm SCREW



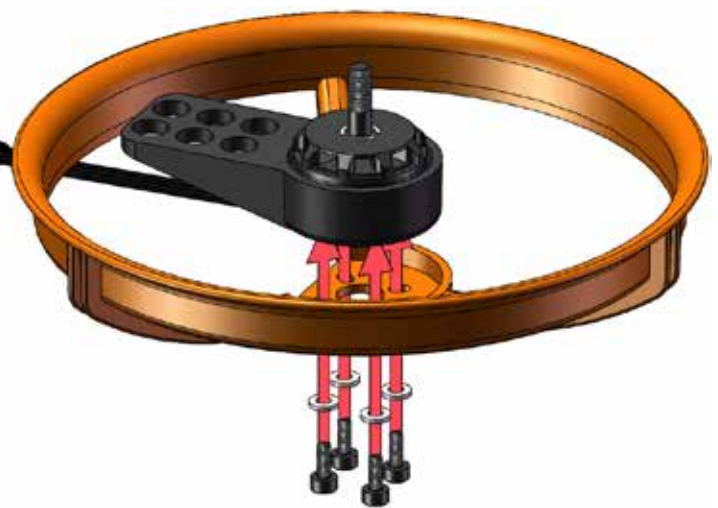
x4
#4 WASHER



x1
COUNTERCLOCKWISE MOTOR AND ESC

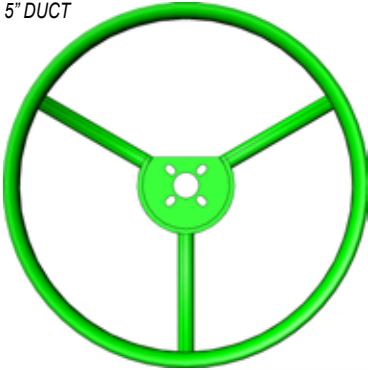


COUNTERCLOCKWISE (CCW) #2



03

x1
5" DUCT



x1
2205 MOTOR MOUNT



x4
M3x8mm SCREW



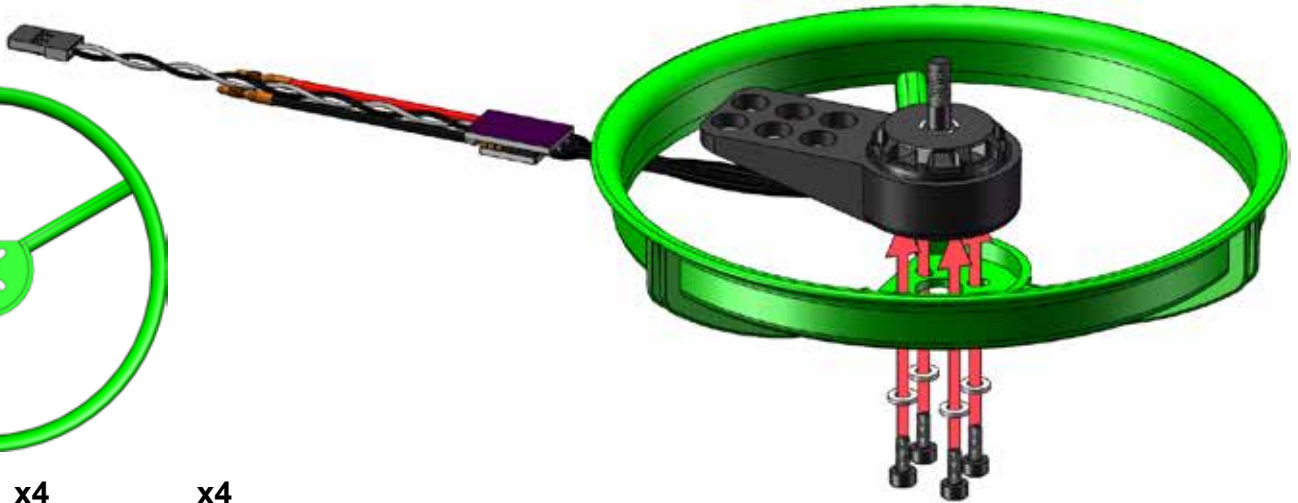
x4
#4 WASHER



x1
CLOCKWISE MOTOR AND ESC

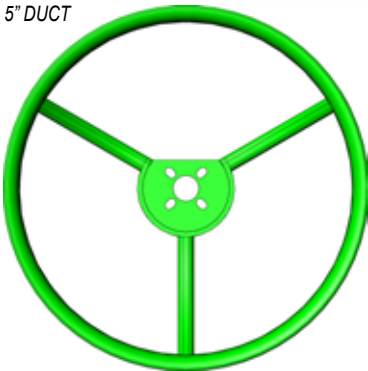


CLOCKWISE (CW) #3



04

x1
5" DUCT



x1
2205 MOTOR MOUNT



x4
M3x8mm SCREW



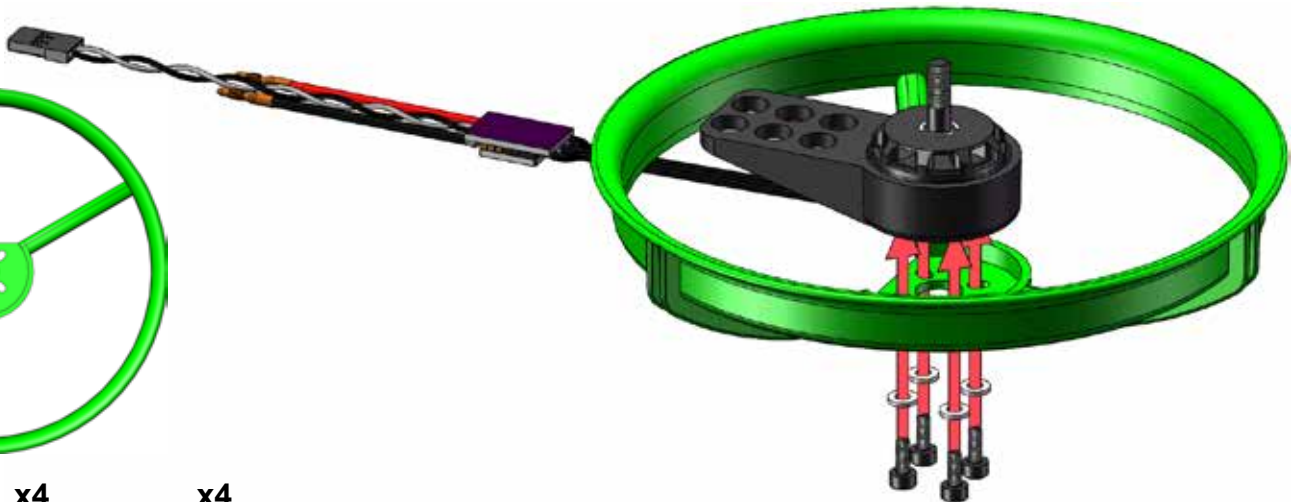
x4
#4 WASHER



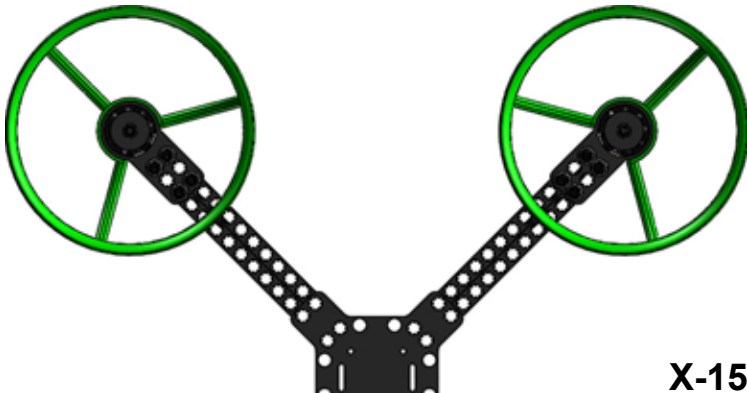
x1
COUNTERCLOCKWISE MOTOR AND ESC



COUNTERCLOCKWISE (CCW) #1



CHOOSE YOUR



X-15

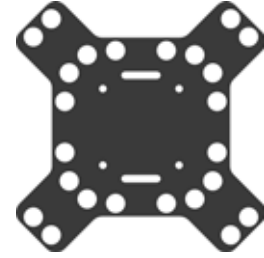


X-10



X-6

X TOP PLATE



x8

15-BEAM



Diagonal size of 405 mm.

Will have a softer flight characteristic. Having the longest arms requires the most time to change angle in the air. Being an X frame it will respond with the same movement forward-backward as it will left-right.

x8

10-BEAM



Diagonal size of 305 mm.

Will have a slightly more responsive flight characteristic. Having the middle length arms requires less time to change angle in the air. Being an X frame it will respond with the same movement forward-backward as it will left-right.

x8

6-BEAM



Diagonal size of 225 mm.

Will have the most responsive flight characteristic. Having the shortest arms requires the least time to change angle in the air. Being an X frame it will respond with the same movement forward-backward as it will left-right.

FRAME & SIZE

STRETCH X TOP PLATE



x8
15-BEAM



Center to center size of 350 mm x 205 mm.

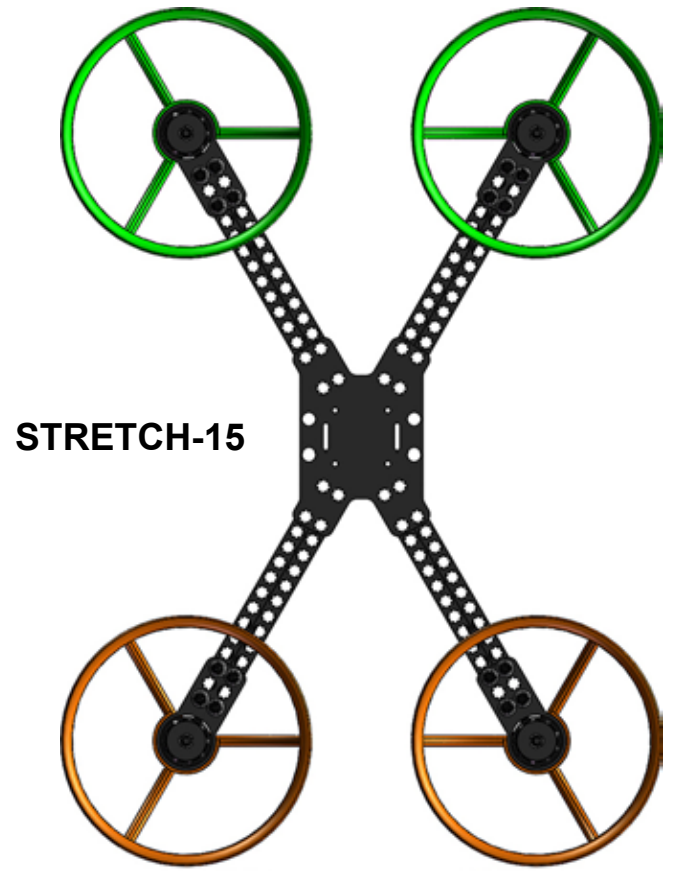
Will have a softer flight characteristic. Having the longest arms requires the most time to change angle in the air. Being a stretch X frame it will be more responsive when steering left-right than forward-backward, ideal for racing.

x8
10-BEAM

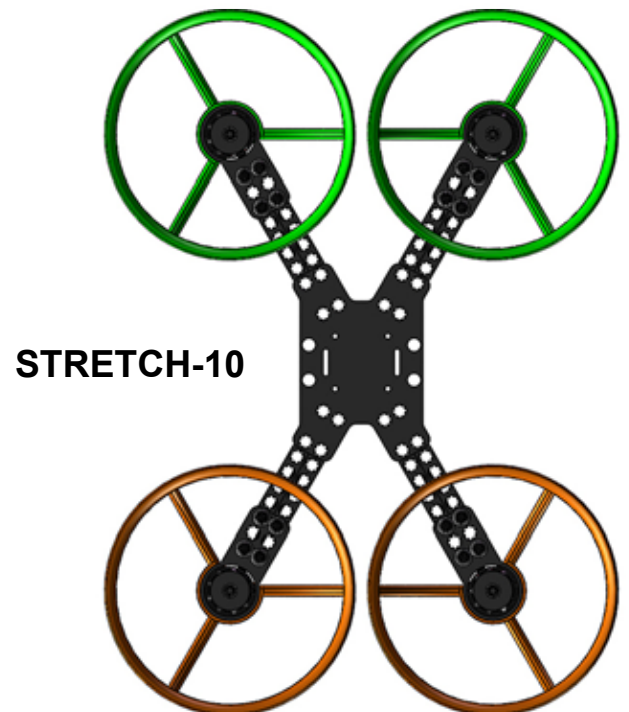


Center to center size of 265 mm x 150 mm.

Will have a slightly more responsive flight characteristic. Having the middle length arms requires less time to change angle in the air. Being a stretch X frame it will be more responsive when steering left-right than forward-backward, ideal for racing.



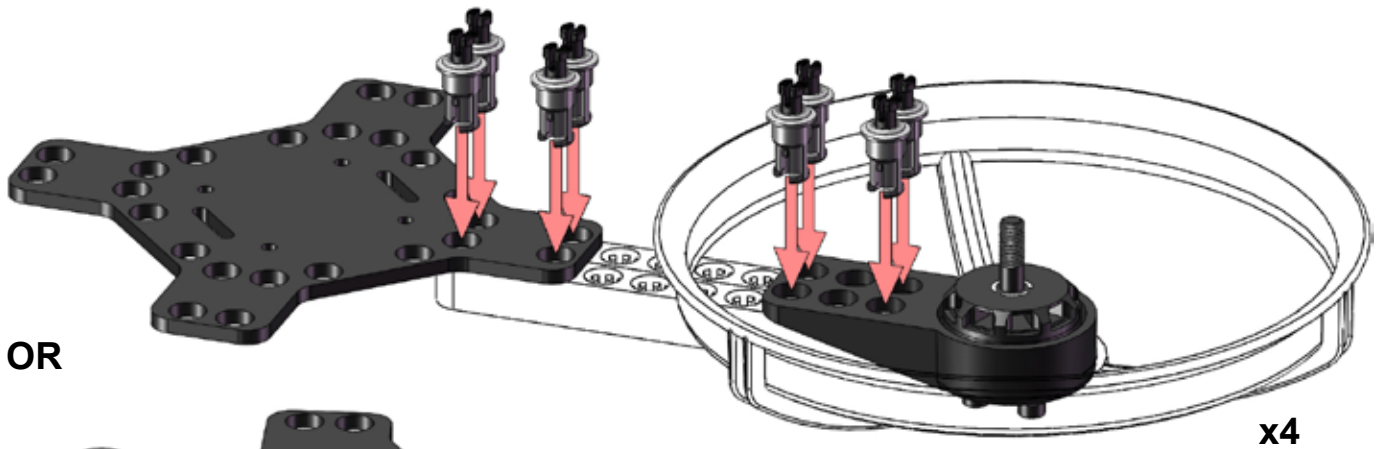
STRETCH-15



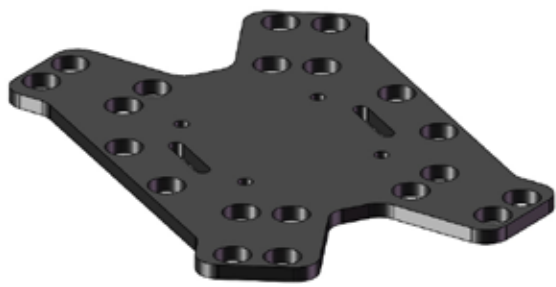
STRETCH-10

05

x32
PANEL-LOCK

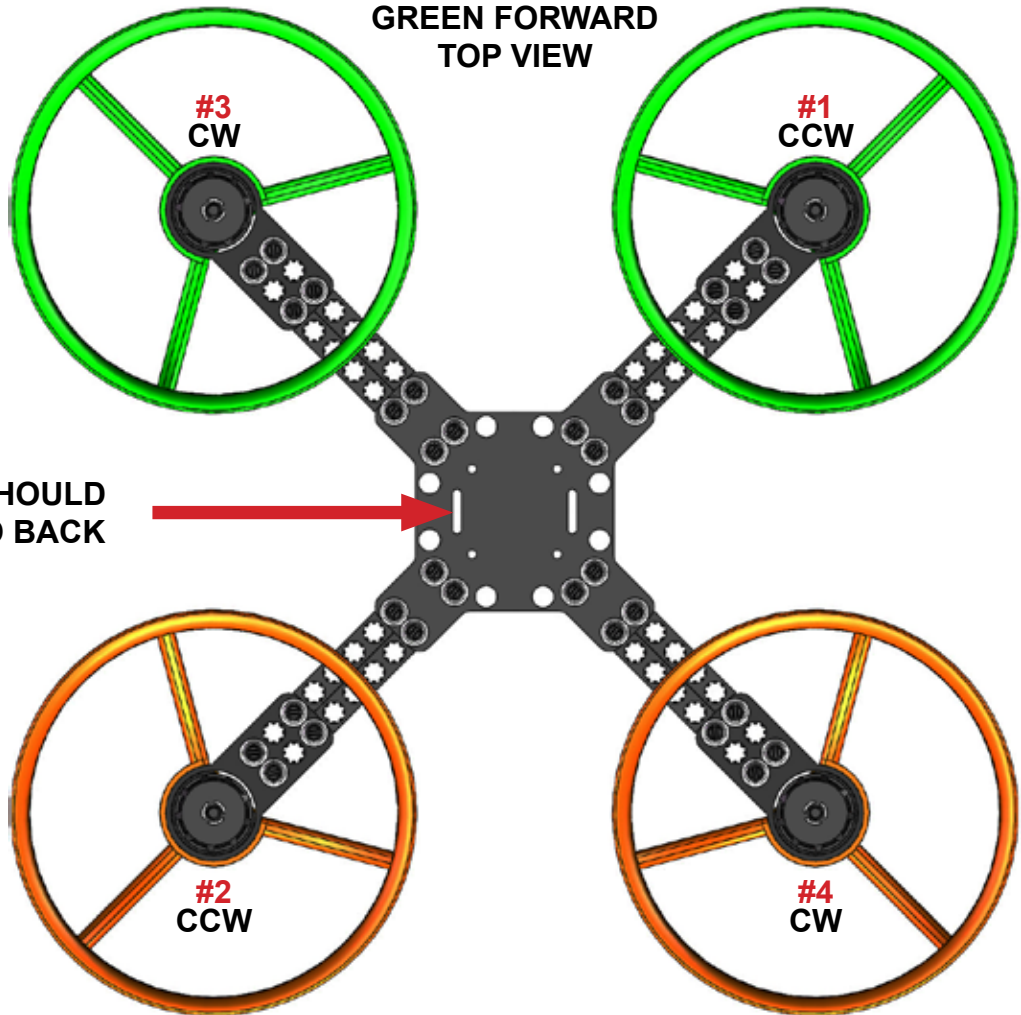


OR



x4

GREEN FORWARD
TOP VIEW



NOTE: SLOTS SHOULD
FACE FRONT TO BACK

06

x4
#4-40 x 5/8" SCREW



x4
#4 WASHER



x4
CLEARANCE THREAD
ADAPTER



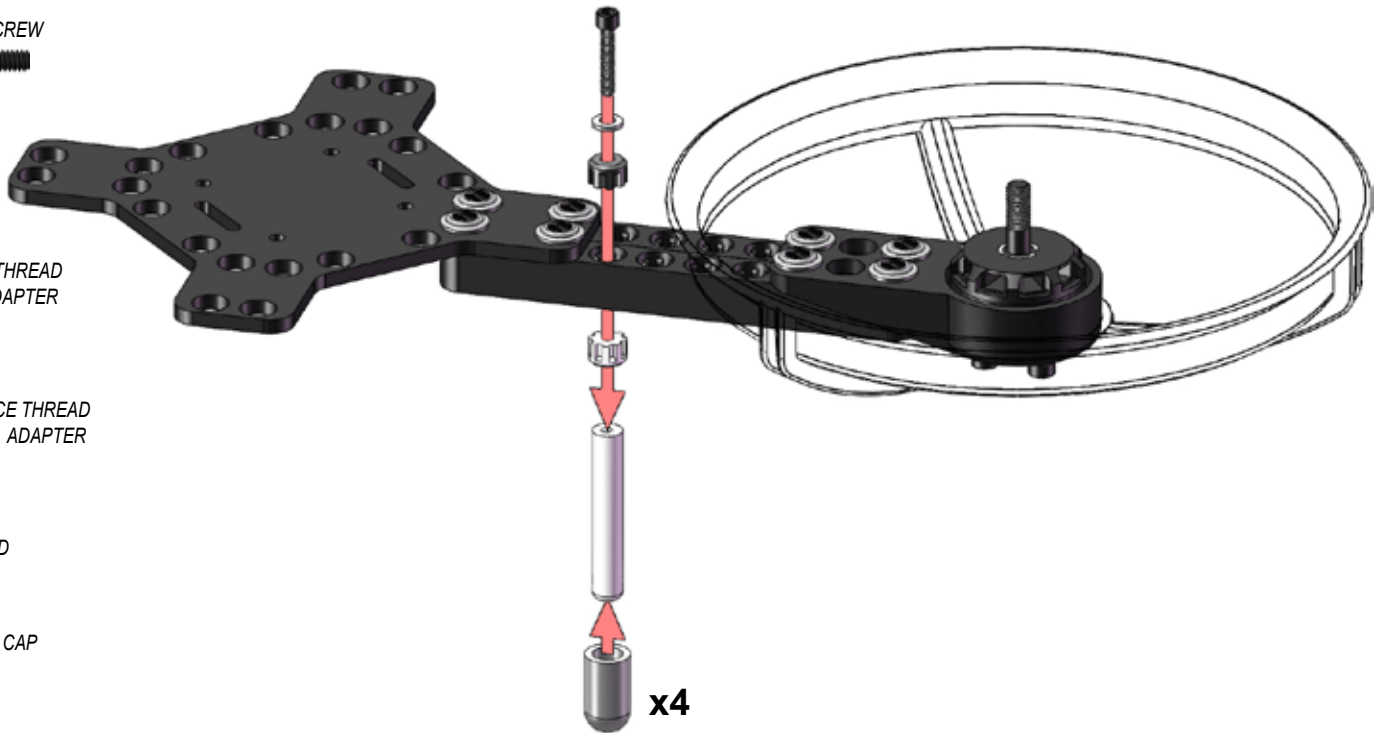
x4
INTERFERENCE THREAD
ADAPTER



x4
SHROUD STUD



x4
1/4" SILICONE CAP

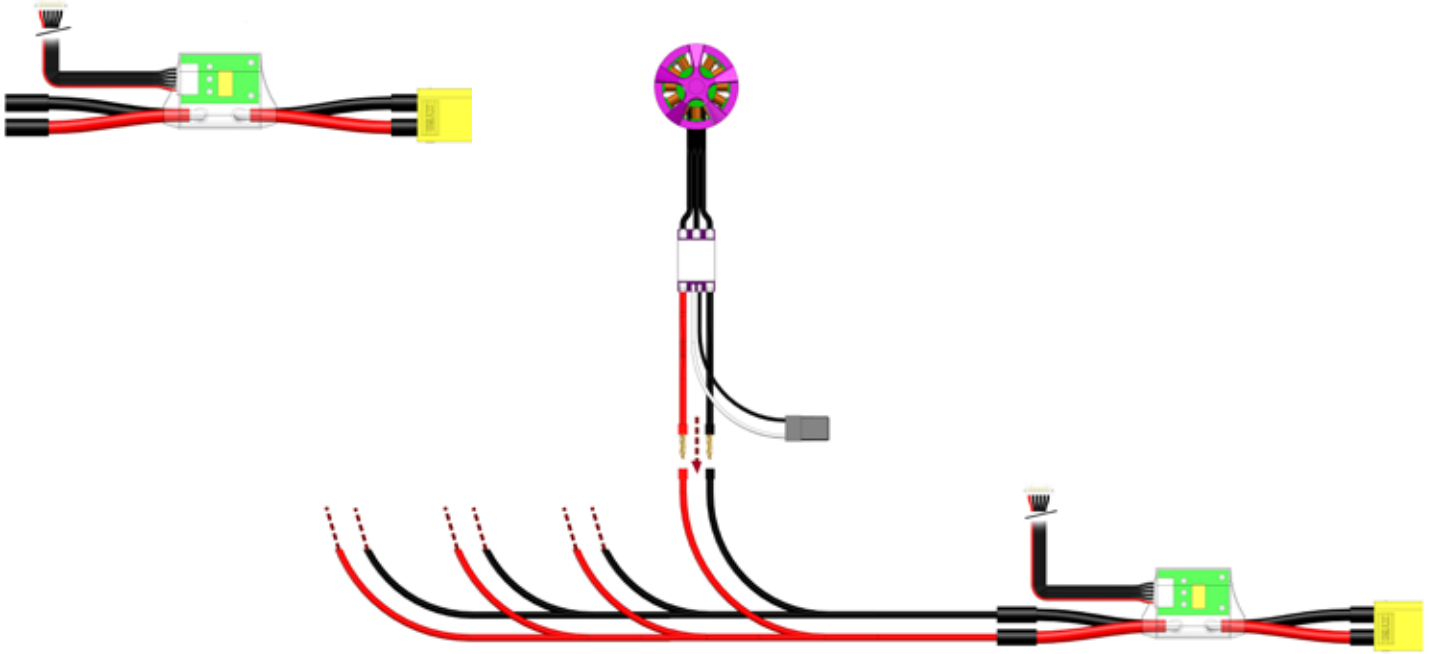


07

Tie the ESC's wire to the arms of the frame.

Connect the motor and ESC assemblies to the power module. Be sure to note the polarity of the ESC's when connecting to the power module (red to red and black to black).

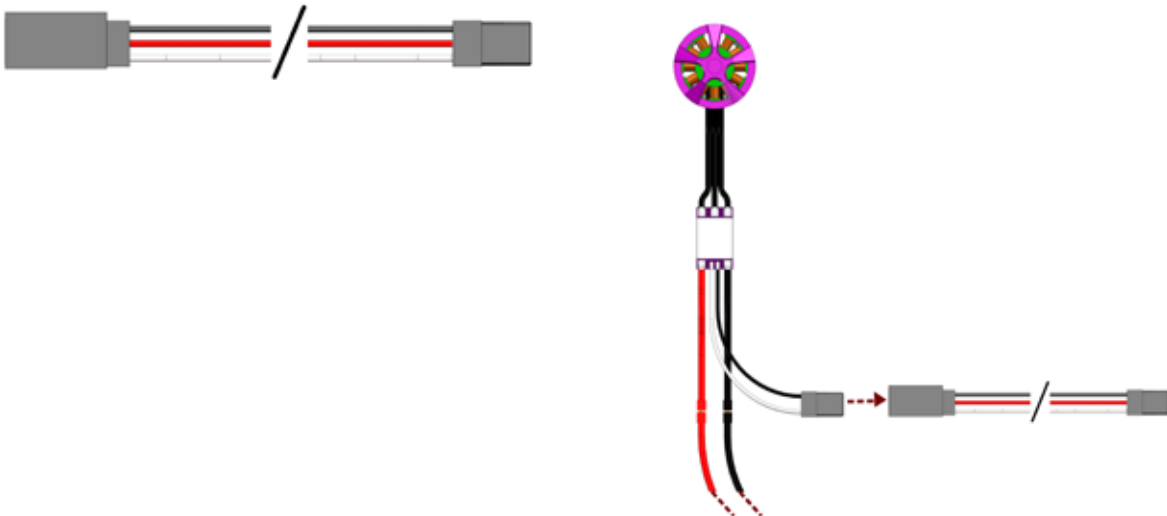
x1
POWER MODULE



08

Connect the extension plugs to the ends of the ESC plugs.

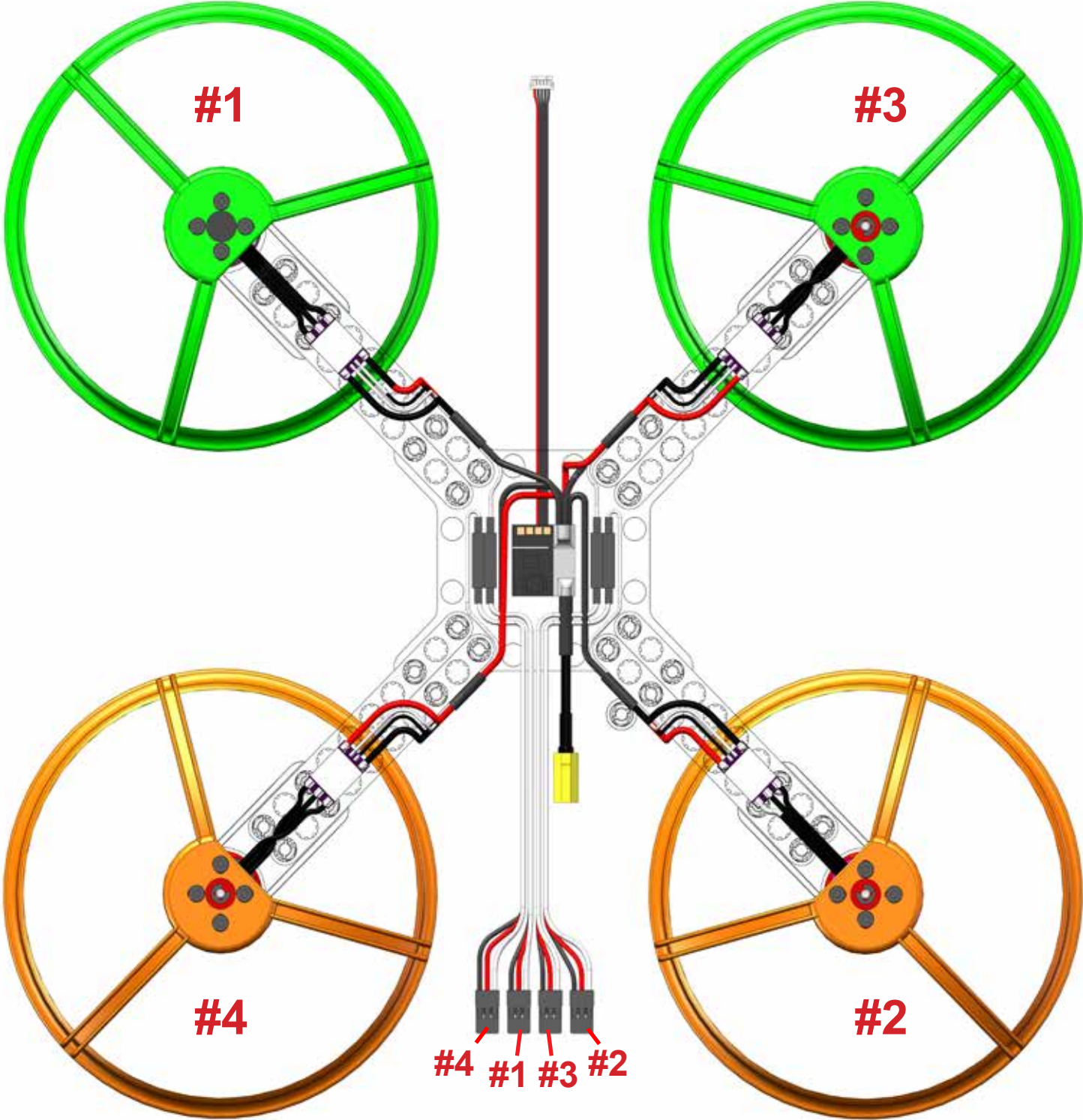
x4
EXTENSION PLUG



09

Mark the black plugs coming from the motor and ESC assemblies with the number of the arm they are attached to (see figure below). Then tuck the connection, with the power module, in-between the frame planes. **LEAVING THE LABELS & THE OPEN PLUGS OUT!**

BOTTOM VIEW



10

x1
VELCRO STRAP

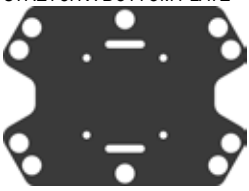


x1
X BOTTOM PLATE



OR

x1
STRETCH X BOTTOM PLATE



11

x8
PANEL-LOCK



12

x1
10-BEAM

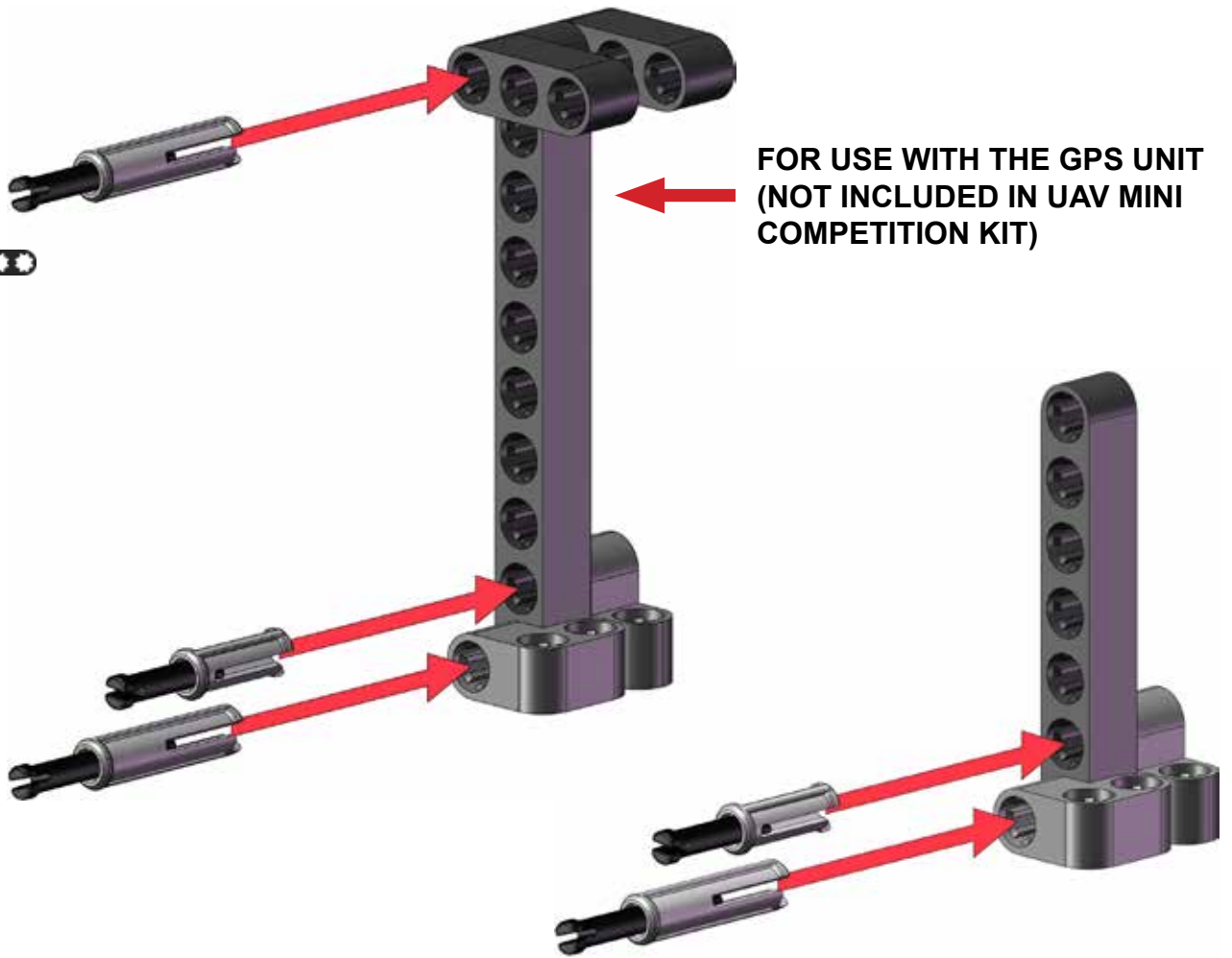
x1
7-BEAM

x2
3-BEAM

x4
TRANSITION

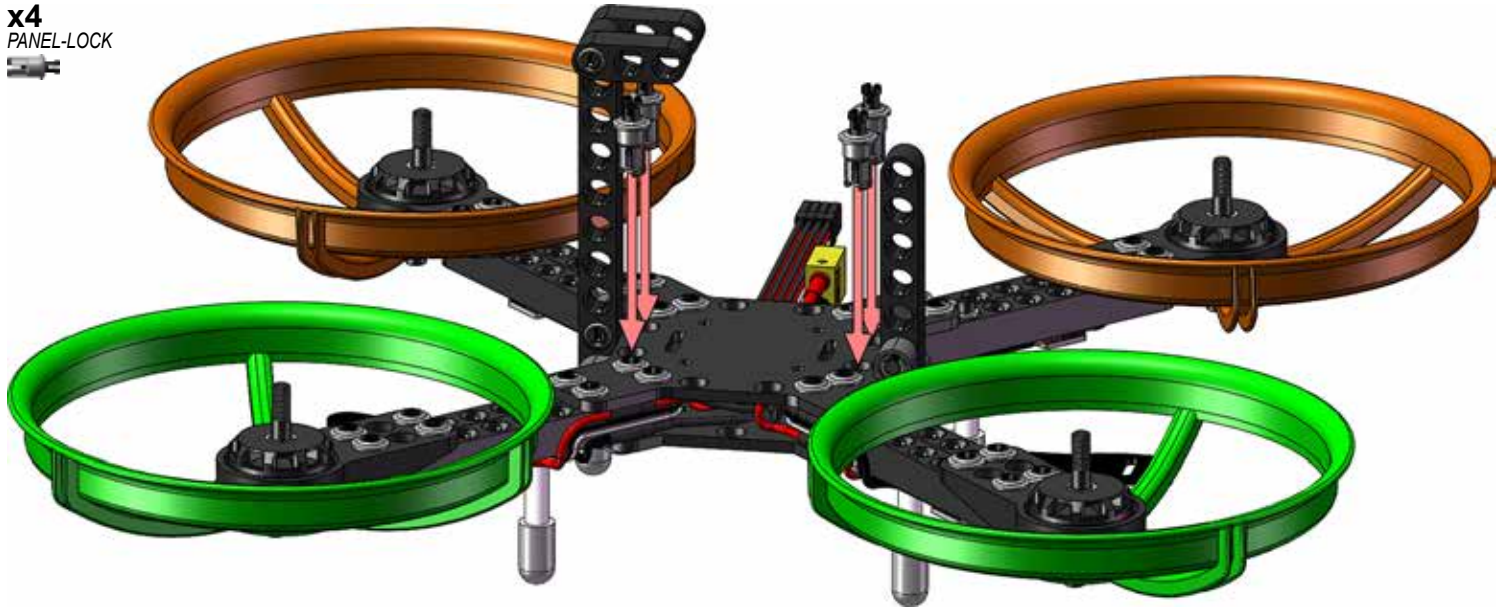
x3
3-LOCK

x2
2-LOCK



13

x4
PANEL-LOCK



14

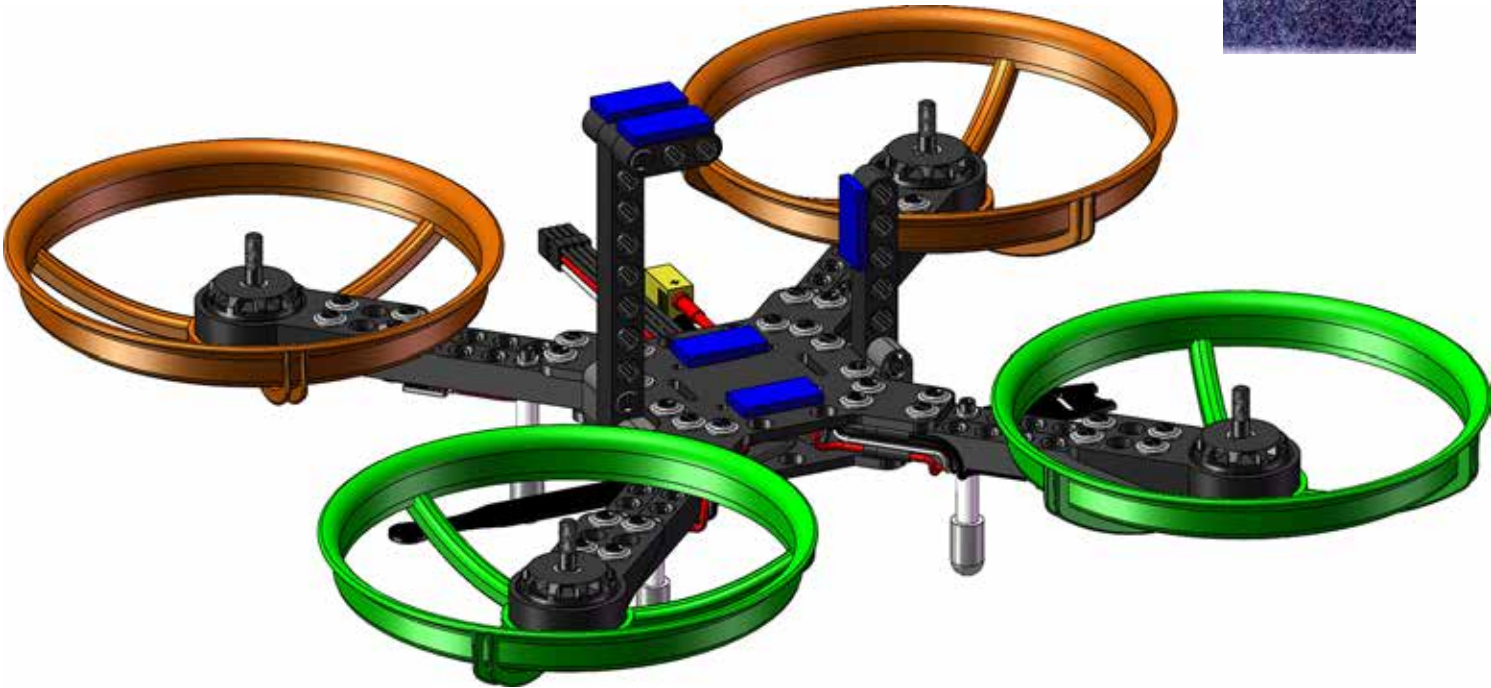
x2
PANEL-LOCK



15

Attach the provided Velcro (loop/soft side) to the places shown in blue. They will be used to secure the electronics.

VELCRO LOOP



16

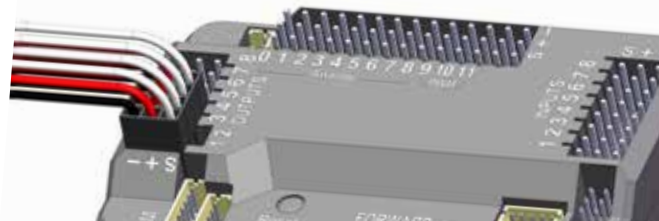
Attach Velcro (hook/rough side) to the telemetry radio (if incl.), Flight controller and GPS / compass module (if incl.). These three electronics modules are mounted as shown below.

Attach Velcro (loop side) to the top of the flight controller as shown in blue.

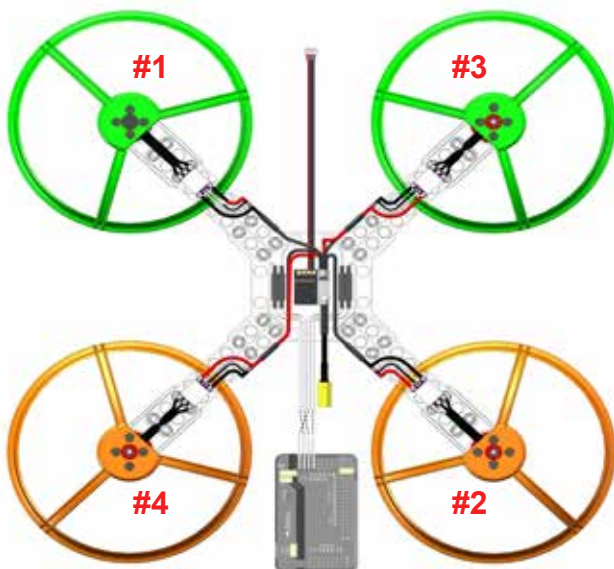


17

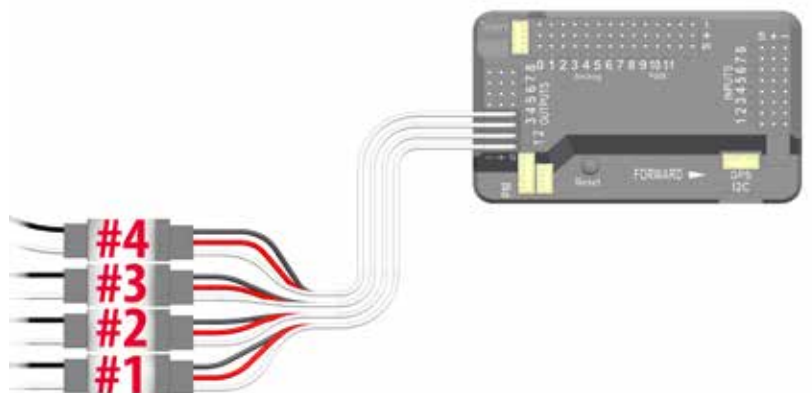
Connect the motor/ESC assemblies to the flight controller. Make certain the polarity (wire/plug orientation) for the ESC's matches the figure below. (See also wiring diagram on pg 11)



BOTTOM VIEW



The ESC's are plugged into the output pins on the flight controller marked 1-4. Refer to the motor number diagram below to match these pins to the motors /ESC's that they connect to.



18

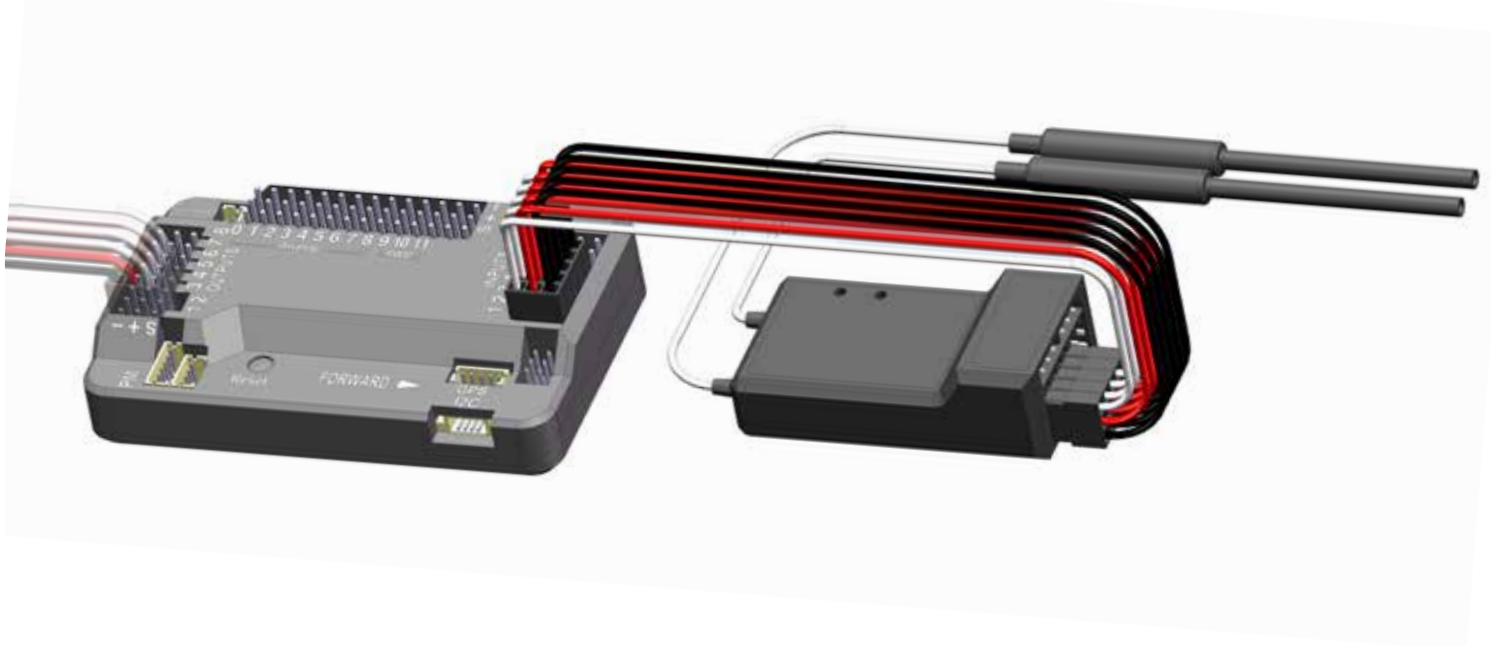
Attach Velcro (hook/rough side) to the radio receiver. It will be mounted as shown below.



19

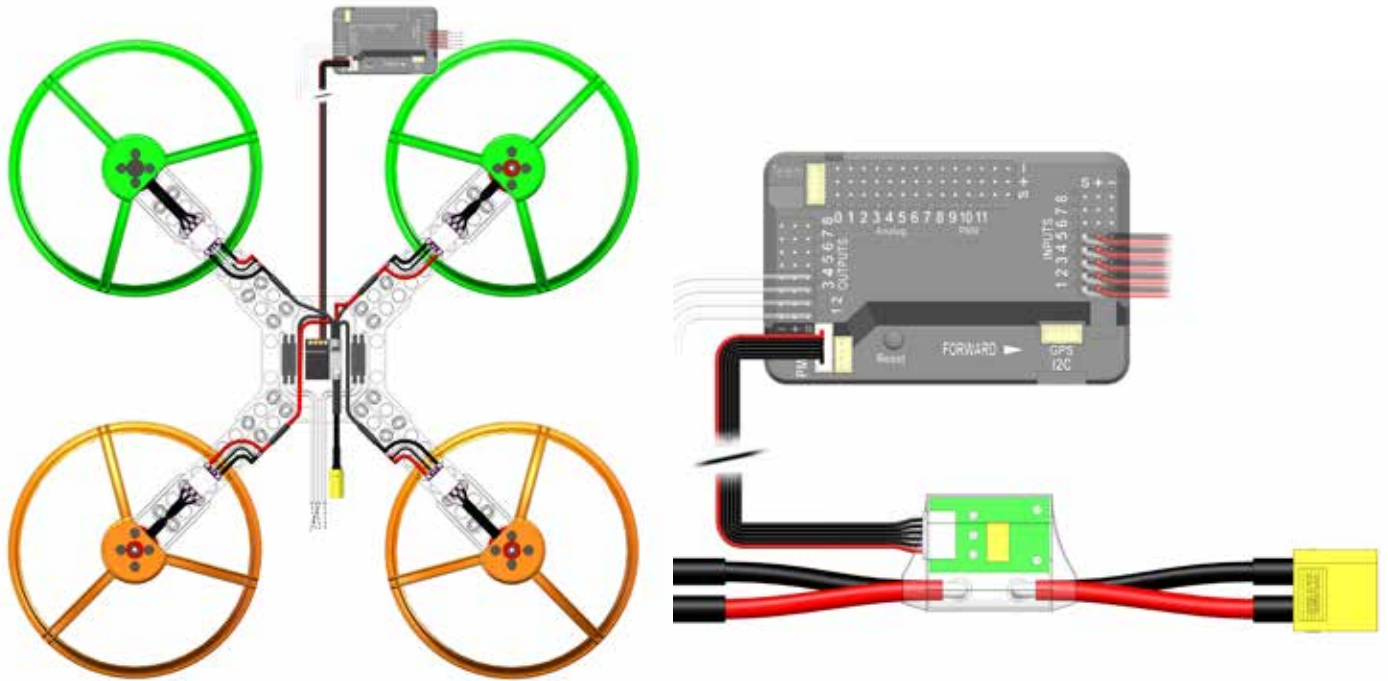
Connect the radio receiver to the flight controller. Make certain that the polarity (plug orientation) is correct. For the plugs to the flight controller the signal (lightest) wire should be inside and nearest the numbers. For the plugs to the receiver, the signal wire will be on top as shown.

The plugs go sequentially into the input pins 1-5 on the flight controller and the ch pins ch1 - ch5 on the receiver. (1 To ch1, 2 to ch2, 3 to ch3, etc.)



20

Plug the 6 pin plug from the power module into the port marked pm on the flight controller. The power module was attached to the drone in step 07.

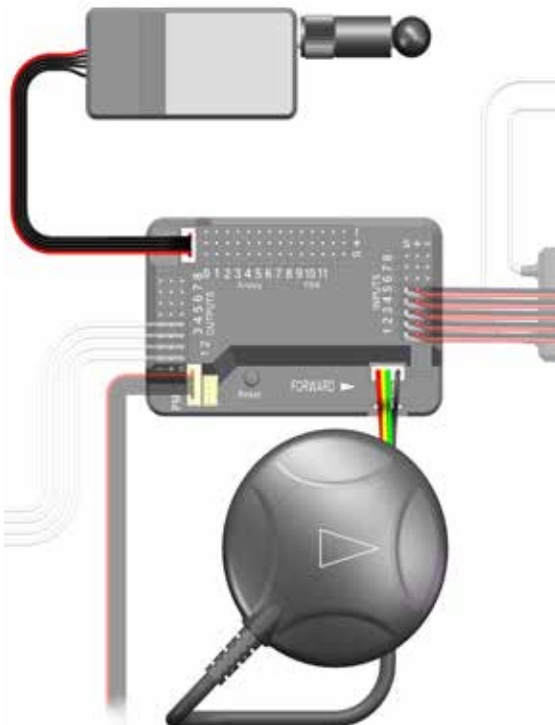


21

Attach the option parts: telemetry radio and GPS / compass module. If you do not have a telemetry radio, the drone can fly without it.

IF YOU DO NOT HAVE A GPS / COMPASS MODULE, SKIP TO NEXT PAGE!

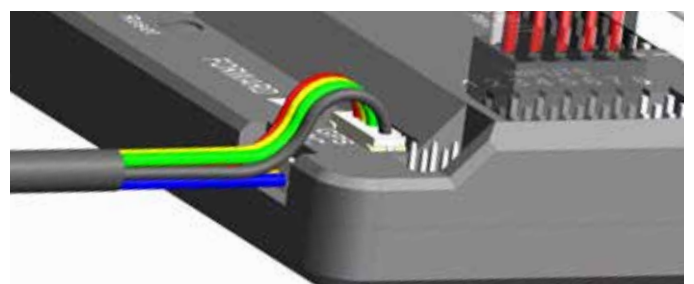
Plug the 5 pin plug from the telemetry radio into the port marked “telem” on the flight controller.



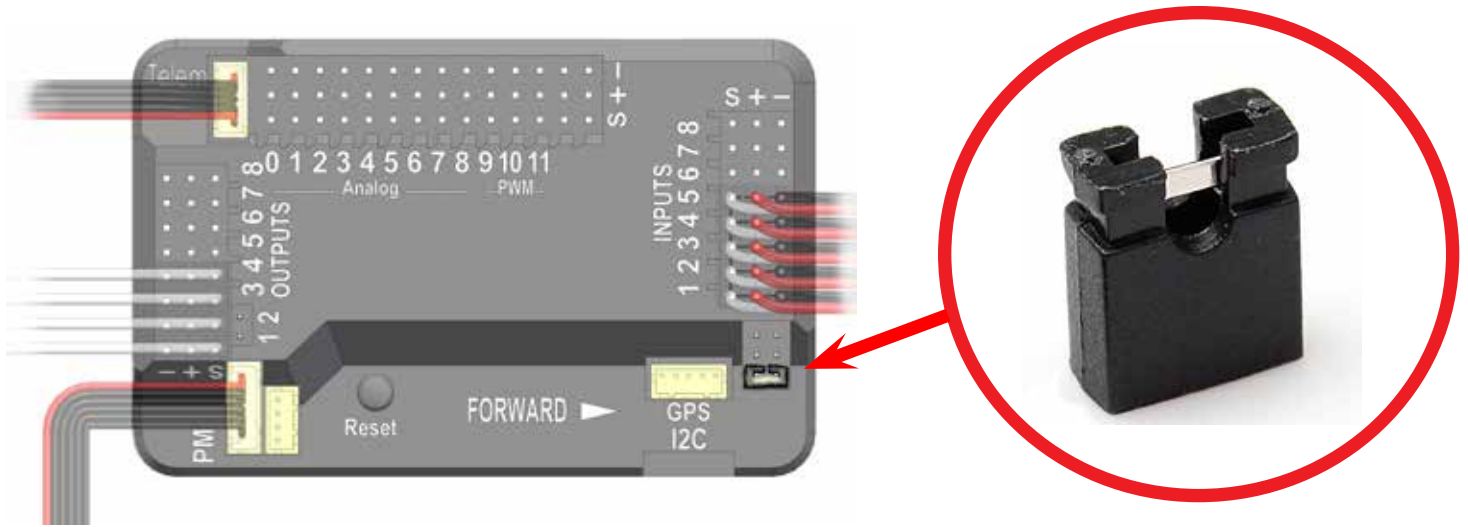
The GPS / compass module has two plugs: a 5 pin and a 4 pin. Both plugs need to plug into the flight controller module. These plugs go into the two sockets labeled “GPS”.

The 5 pin goes into the top face above the “GPS” label. The 4 pin plug goes into the side face below the “GPS” label as shown below.

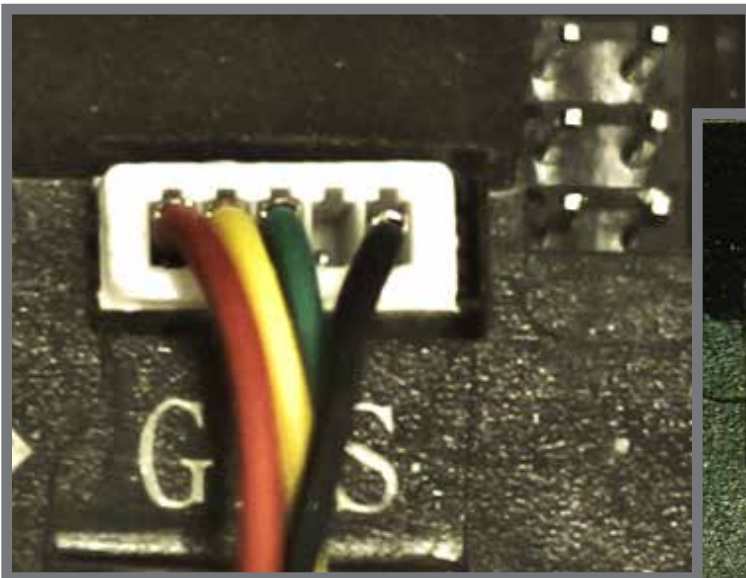
TO GPS ←



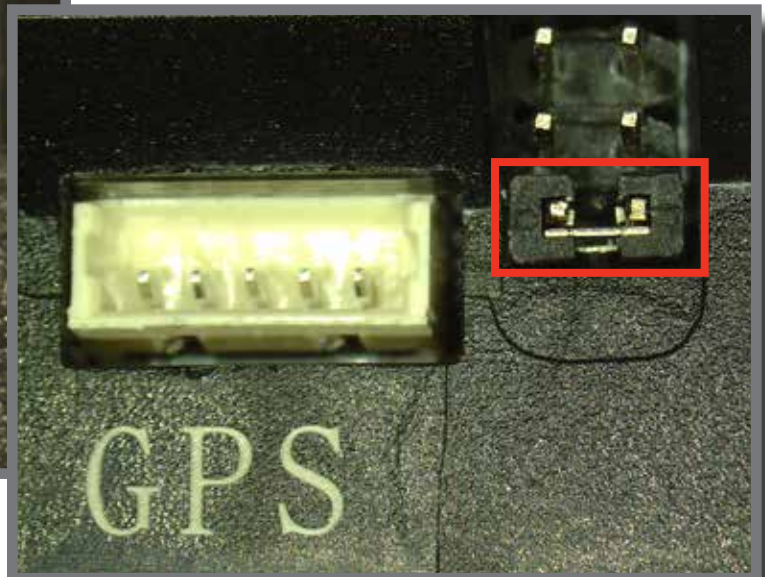
**THE FOLLOWING IS FOR THE UAV MultiRotor COMPETITION KIT
AND/OR FOR FLIGHT WITHOUT THE GPS.**



With the flight controller orientated as shown above, insert the included jumper into the bottom pair of pins as indicated. For models not using the GPS/ compass module, this allows the use of the internal compass module.



Without the Jumper



With the Jumper

22

Attach all the loose cables to the drone body. Make certain that the propellers are not obstructed.



Flight Controller Programing

Warning!

Before continuing further, please ensure that you have **NOT** mounted the propellers on the MultiRotor.



01

Introduction

The following steps will cover programming the flight controller. There are three parts to this:

- Calibrating the sensors
- Calibrating the ESC's
- Loading the quadcopter flight control program

Data is saved in the flight controller or ESC's after each step. **ALL THREE STEPS MUST BE COMPLETED FOR THE DRONE TO FLY.**

01

Plug the flight controller unit now mounted on the drone into the computer using the USB cable.



02

Open the Arduino program loaded on the computer.

For more information on installing and working with Arduino see the “Arduino Users Guide” included with this kit.

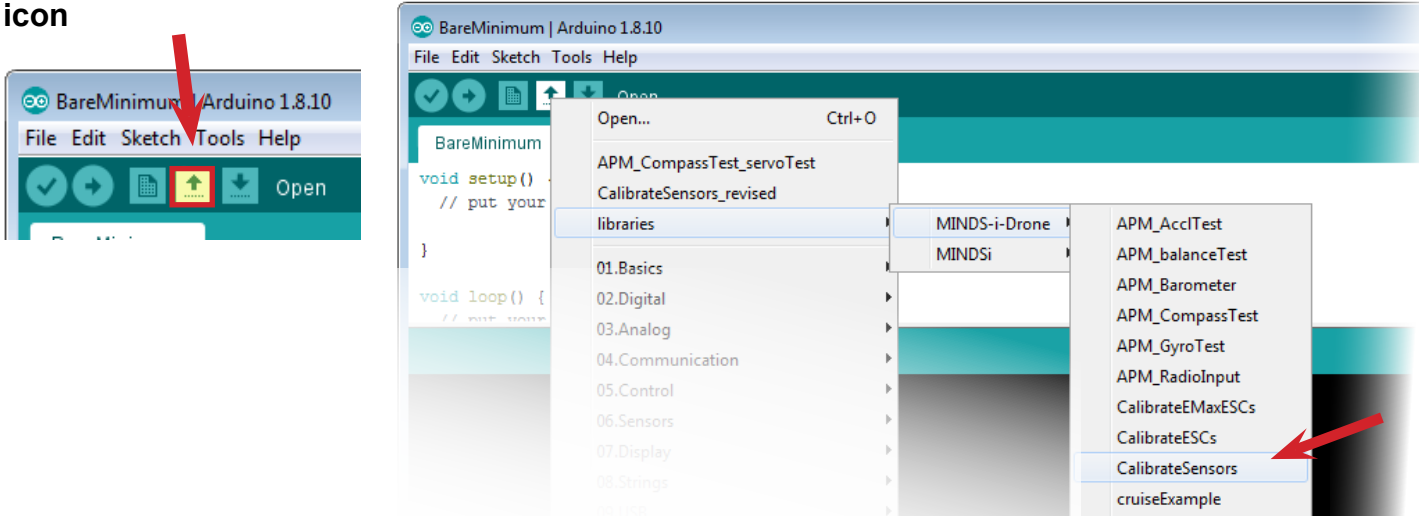
02

Calibrate Sensors

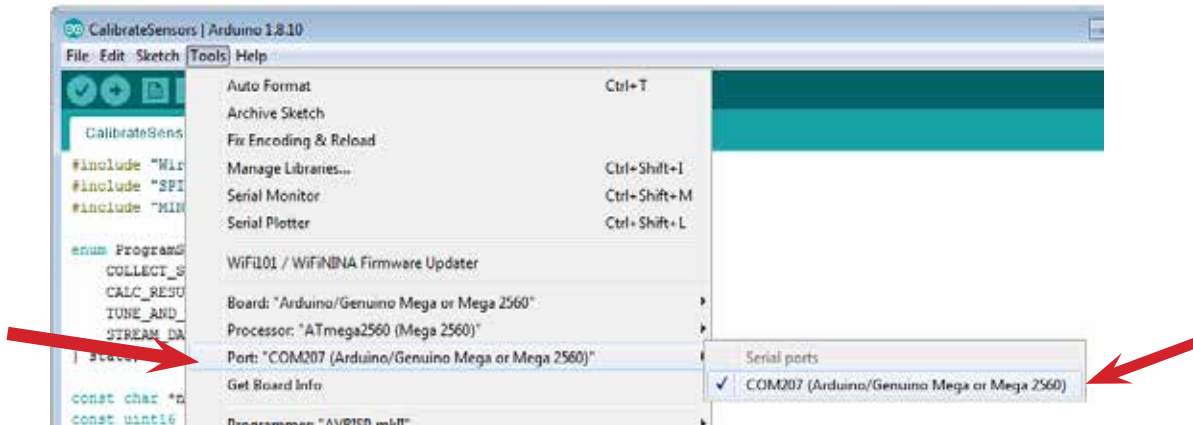
01 In Arduino, open the program: CalibrateSensors

OPEN: libraries > MINDS-i-Drone > CalibrateSensors

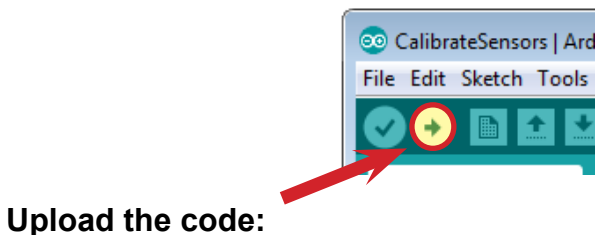
Click the open icon



02 Check that the correct board (mega 2560) and port are selected as shown:

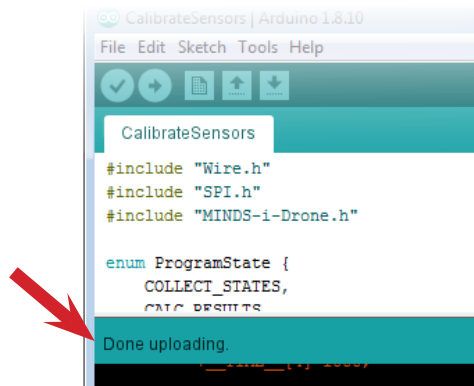


03 Upload the calibrate sensors code onto the flight controller:



Upload the code:

Wait until the upload completes:



04

Once the upload is complete, open the serial monitor:

Click the serial monitor icon.

Wait until a message is displayed in the serial monitor.

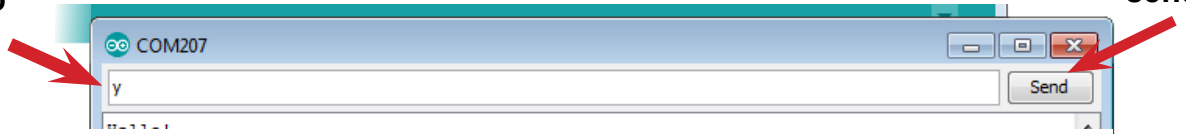


05

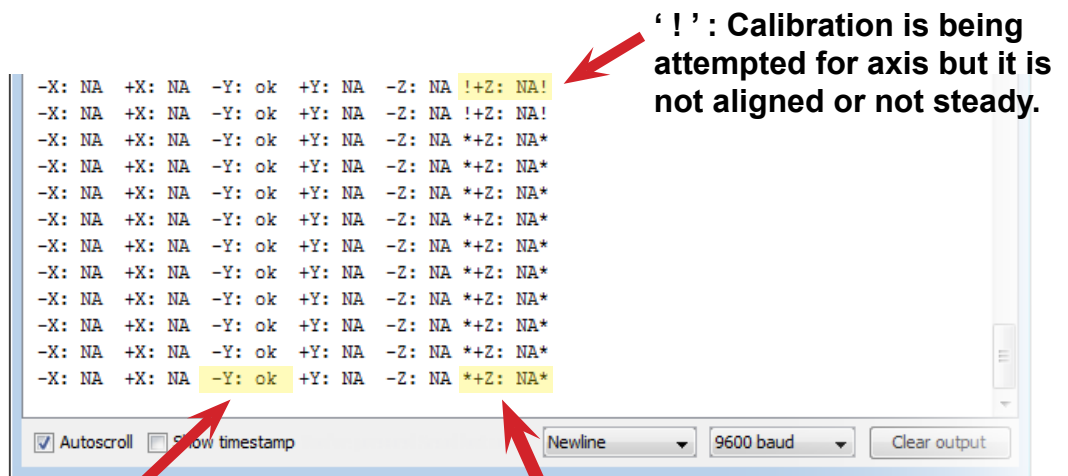
Once the message is displayed answer yes to the prompt.

Enter 'y' in the top bar.

Hit send.



Lines of scrolling text will appear with labels for the axes: x,y and z. Each axis will have two columns, one for its positive direction and one for its negative direction.



'!' : Calibration is being attempted for axis but it is not aligned or not steady.

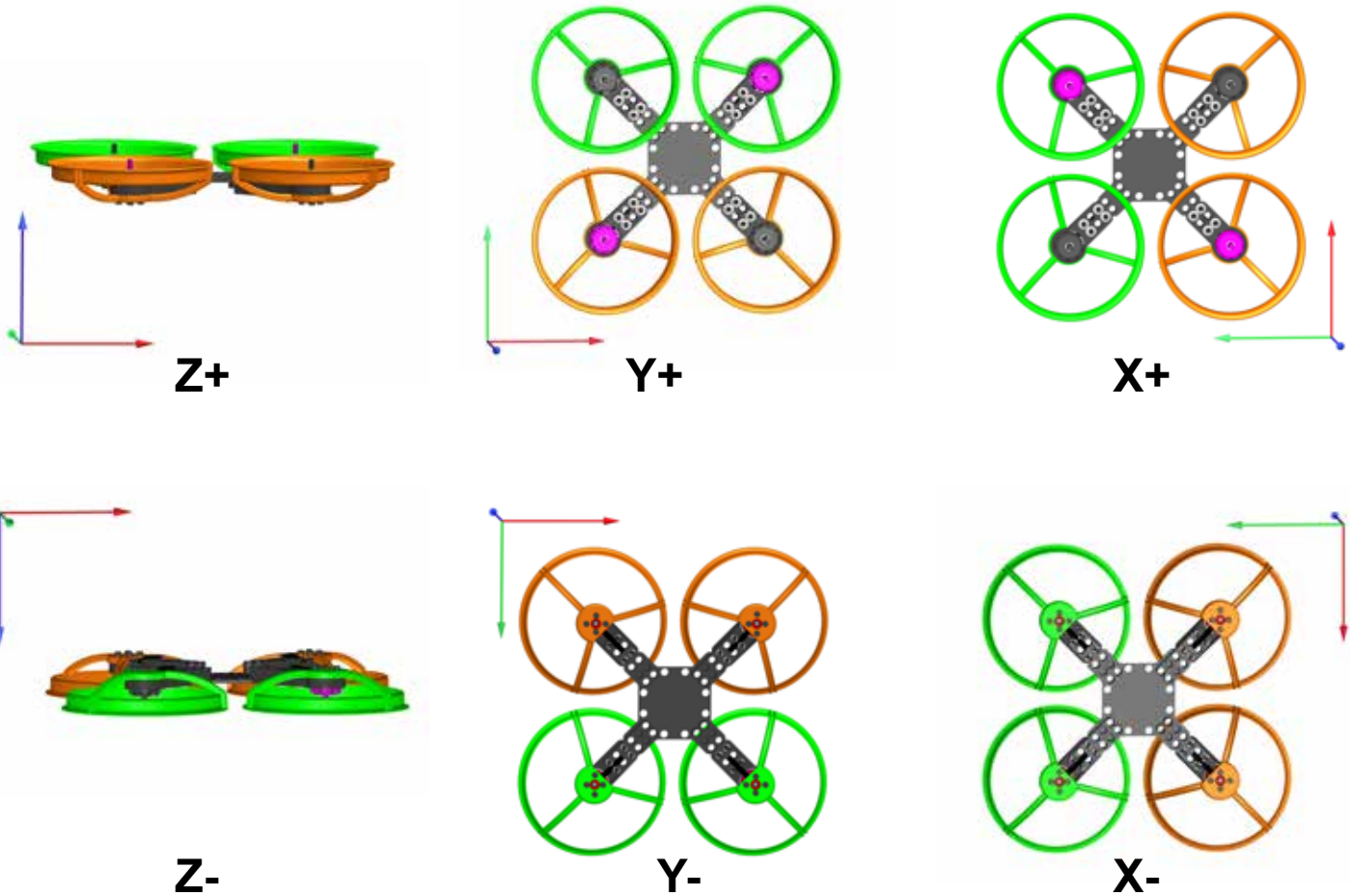
'ok' : Axis calibration is complete.

'*' : Axis is being calibrated.

06

Calibrate the accelerometer chip for each of the six possible orientations as shown below.

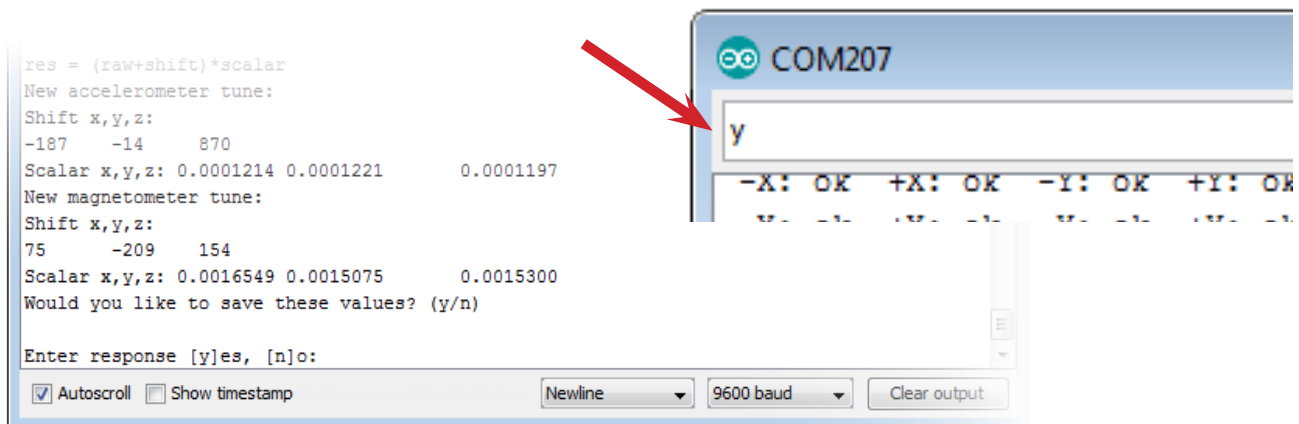
For each orientation hold the drone as steady as possible until the indicator beside the orientation label changes from “NA” to “ok”.



Once the accelerometer has been calibrated for all axes, the scrolling will stop.

07

Once the scrolling stops answer the prompt with ‘y’.



Another screen with scrolling values will appear.

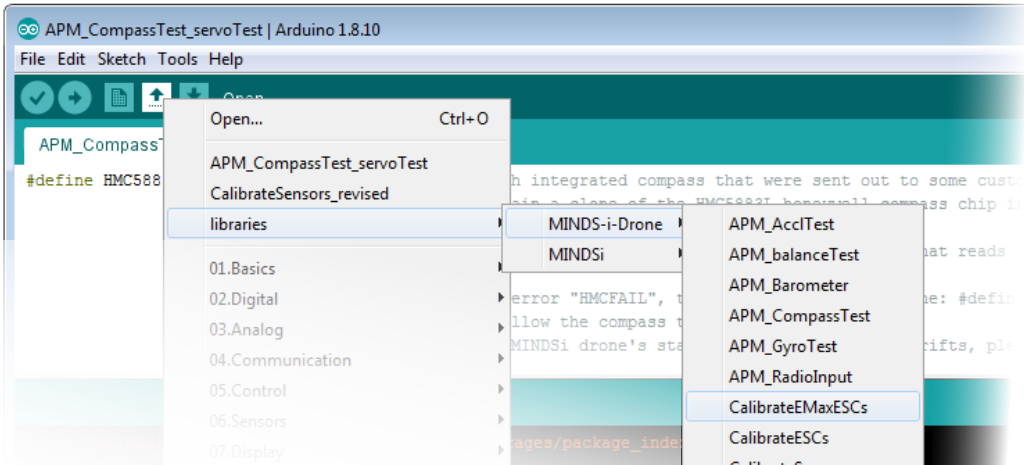
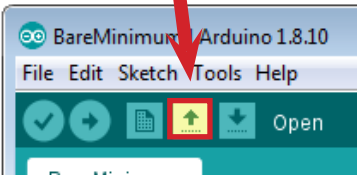
03

Calibrate ESC's

01 In Arduino, open the program: CalibrateEMaxESCs

OPEN: libraries > MINDS-i-Drone > CalibrateEMaxESCs

Click the open icon



02 Under the "Tools" menu, check that the correct board (mega 2560) and port are selected as shown:

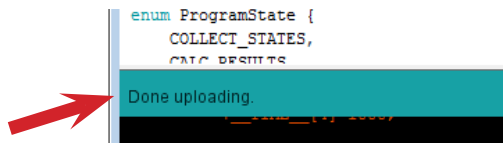


03 Upload the code onto the flight controller:



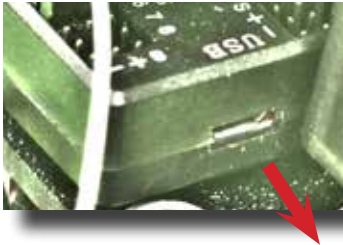
Upload the code:

Wait until the upload completes:



04 **UNPLUG** the USB cable from the drone and then plug the battery into the drone. Wait 30 to 40 seconds until the tones stop.

UNPLUG THE USB!



Plug in the battery and listen to the tones.

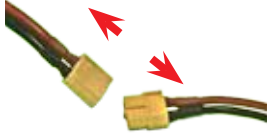


Once the tones stop unplug the battery.

04

Upload The Flight Code

01 MAKE CERTAIN **THE BATTERY IS UNPLUGGED**. Then plug the flight controller into the computer with the USB cable.



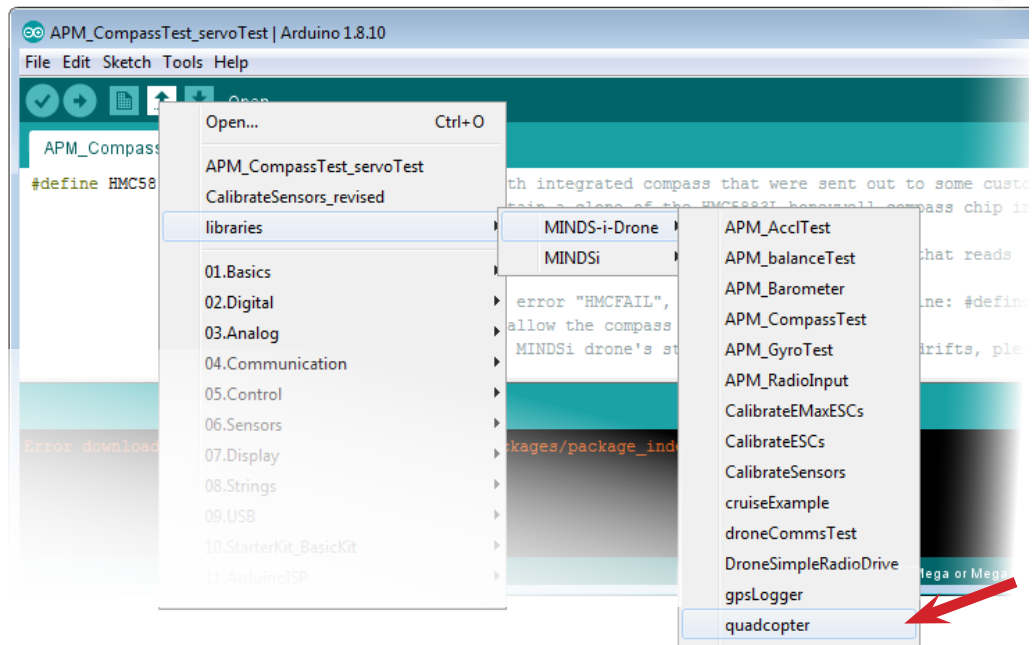
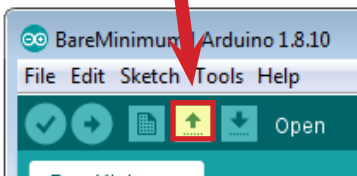
The small end of the USB cable goes into the "USB" slot on the flight controller.



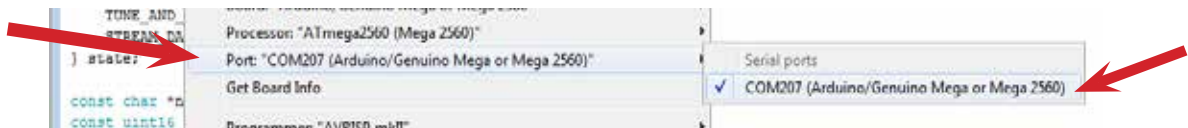
02 In Arduino, open the program: quadcopter

OPEN: libraries > MINDS-i-Drone > quadcopter

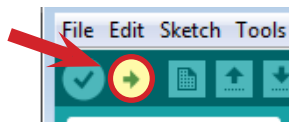
Click the open icon.



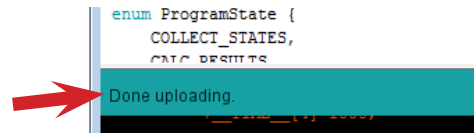
03 Under the "Tools" menu, check that the correct board (Mega 2560) and port are selected as shown:



04 Upload the code onto the flight controller:



Wait until the upload completes:



Once the upload completes, unplug the USB.

Preflight Setup & Testing





Setup The Transmitter

TURNIGY TGY-I6S

Transmitter Operation Reference:



Turing the transmitter on:

Move left stick down



Move all the switches up.



HOLD BOTH BUTTONS AT THE SAME TIME UNTIL IT TURNS ON




Turn the transmitter off by pressing and holding both buttons simultaneously until it turns off.



HOLD BOTH BUTTONS AT THE SAME TIME UNTIL IT TURNS OFF



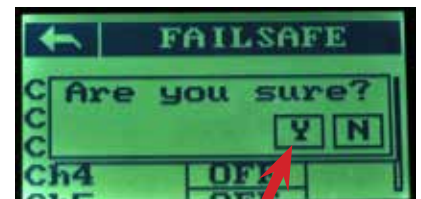
To get into the configuration menu press: "Setup". 



Once in a menu, to save changes and/or exit back to the main screen, press the back icon  as many times as necessary.



If a prompt appears, answer "Y" to save changes.



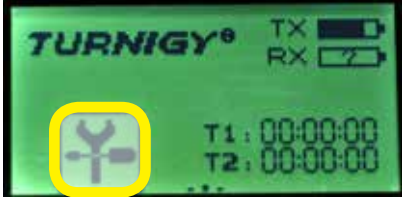
SET THE FAILSAFE FOR THE THROTTLE BEFORE ATTEMPTING FLIGHT.

01

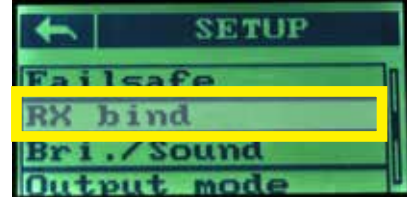
Bind the transmitter to the receiver on the drone.

This step allows the transmitter unit to control a specific drone. **MAKE CERTAIN THE BATTERY IS NOT PLUGGED INTO THE DRONE.**

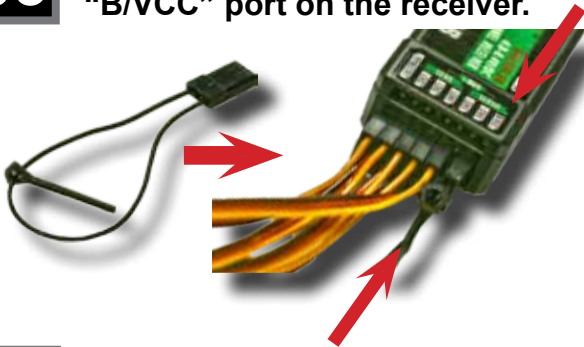
01 From the main screen of the transmitter press: 



02 Scroll down to "RX bind" and press it.



03 Connect the bind cable to the: "B/VCC" port on the receiver.



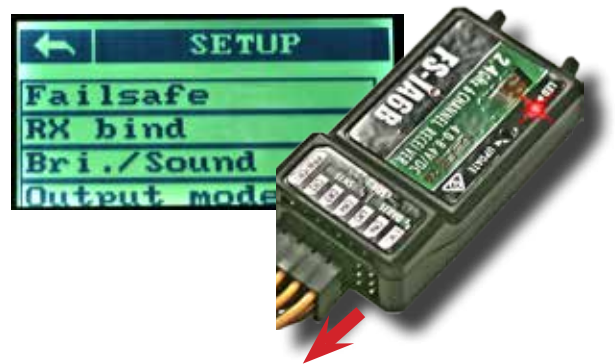
04 Make certain the transmitter is plugged into the flight controller. Plug the flight controller into the computer.



05 Wait for the led on the receiver to stop flashing.



06 When the led turns solid **REMOVE THE BIND CABLE.**

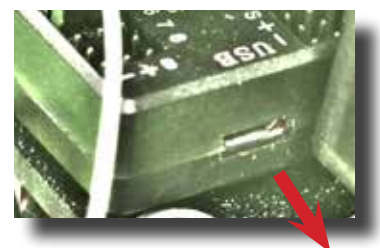


07 Press  to finish and return to the main screen.

If the bind was successful the battery icon to the left of "RX" should be partially filled instead of showing a question mark.



08 The USB power cable may now be unplugged from the drone.




02

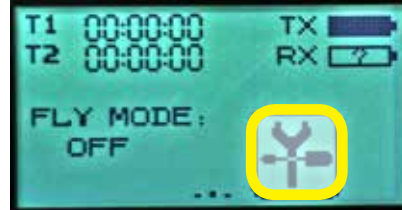
Set the failsafe. This controls behavior when radio contact is lost.

The failsafe should be set such that the drone reduces throttle and comes DOWN if radio contact is lost. **IF THE FAILSAFE IS NOT SET PROPERLY THE DRONE MAY BE STUCK AT FULL THROTTLE WHEN SIGNAL IS LOST!**

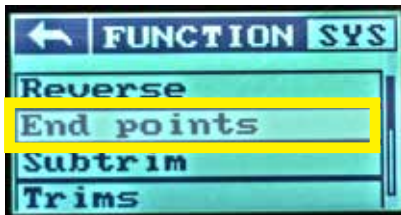
01 Push the left stick down then turn the transmitter on. (If it is not already on)



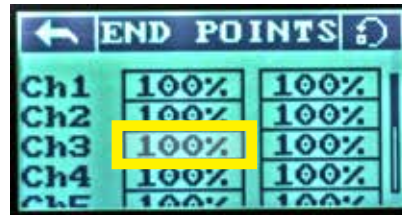
02 Press the setup button  Scroll to "End points".



03 Press: "End points", and look for "Ch3" in the menu.



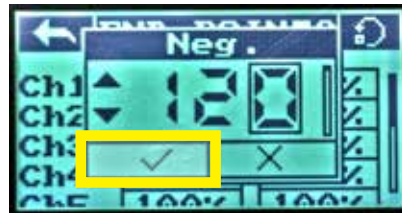
04 Press the indicator box directly after "Ch3".



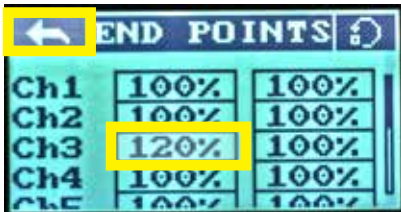
05 Press the up arrow to the left to increase the number to "120".



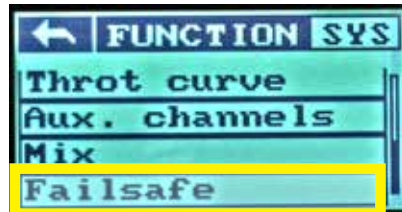
06 Once the numbers read "120" press the check mark.



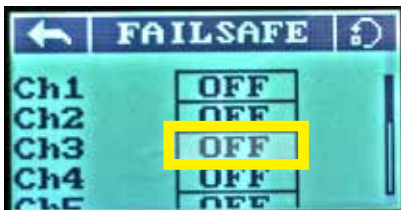
07 The number next to "Ch3" should now read "120%". Exit with .



08 Scroll to "Failsafe" and press it.



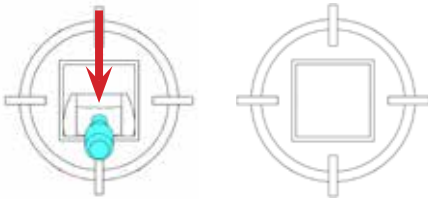
09 Look for "Ch3" and press the indicator box to the right.



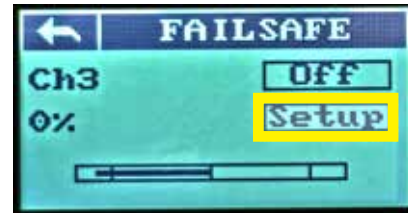
10 If the menu below appears, press "On".



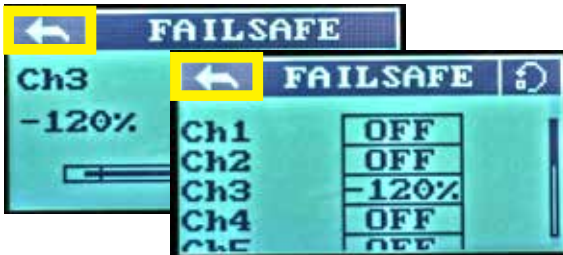
11 Move the left stick (throttle) all the way down.



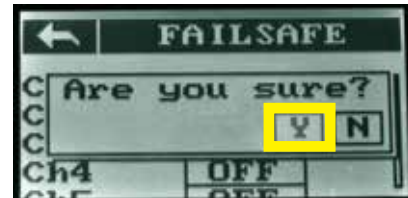
12 Once the throttle is all the way down, press: "Setup".



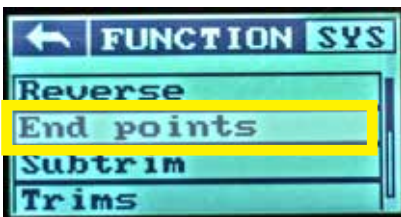
13 Exit with the back icon  twice.



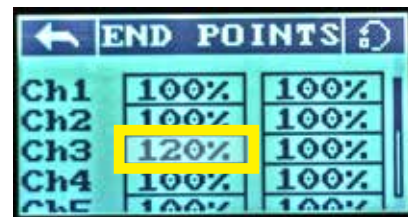
14 Answer the prompt "Y". (If it appears)



15 Scroll to "End points" and press it.



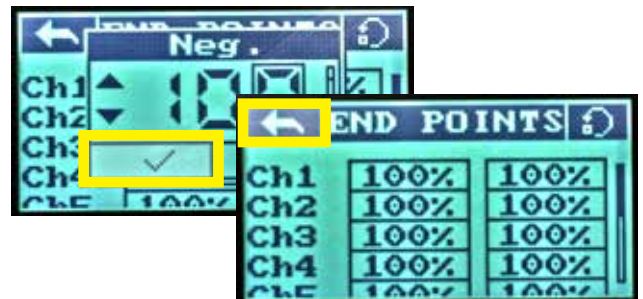
16 Press the indicator box directly to the right of "Ch3".



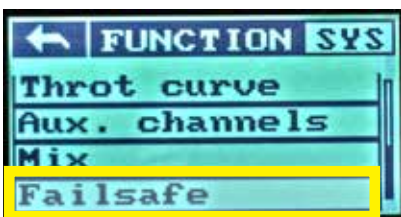
17 Use the down arrow to reset the number to "100".



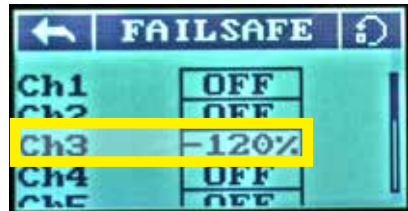
18 Press the check. Then press  to exit.



19 Double check the "Failsafe" value. Press "Failsafe" in the menu.



20 Check that the failsafe value for "Ch3" is correct. It should read "-120%".



21 Exit to the main menu using  as many times as necessary

**THE DRONE MAY DESCEND RAPIDLY WHEN SIGNAL IS LOST.
NEVER FLY ABOVE PEOPLE!!!**

03

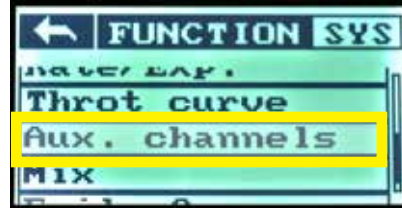
Assign the aux channel.

This step configures the channel five switch on the top of the radio transmitter so that it will work to control flight modes.

01 From the main screen of the transmitter press: 



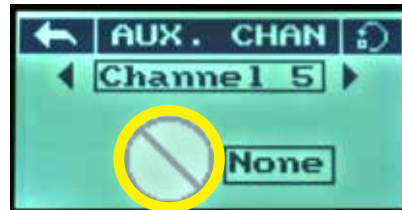
02 Find "Aux. channels" and press it.



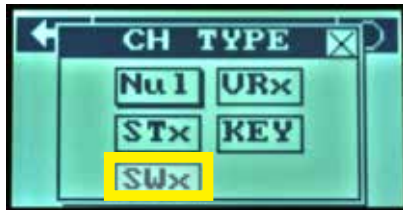
03 Use the arrows if necessary to select "Channel 5".



04 Press the:  icon.



05 Select: "SWx"



06 Press the  icon to save.



07 Press  again to return to the main screen.

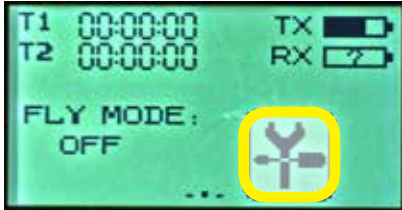


04

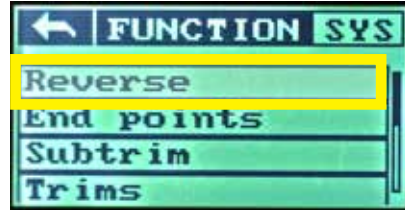
Reverse the 1st and 4th channel.

This step reverses the channels that control roll and yaw.

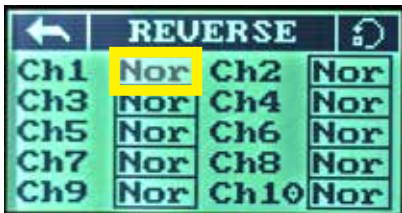
01 From the main screen of the transmitter press: 



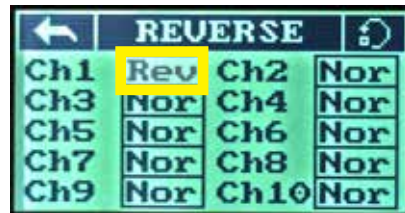
02 Find "Reverse" and press it.



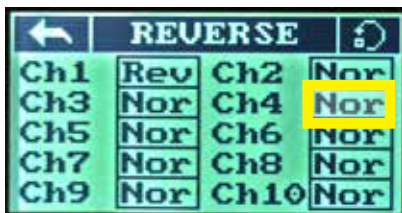
03 Find "Ch1". Press the box to the right of "Ch1".




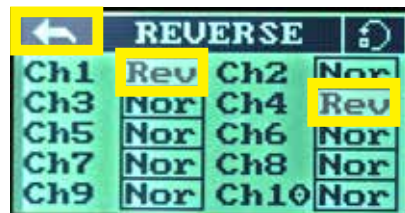
04 The box next to "Ch1" should now read "Rev".



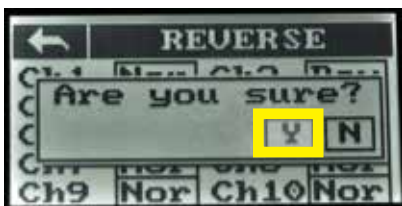
05 Repeat this for Ch4.




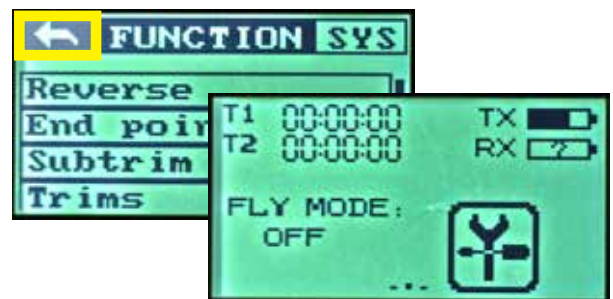
06 The boxes next to "Ch1" and "Ch4" should now read "Rev". Exit with 



07 Answer "Y" to the prompt, if it appears.



08 Press  again (if needed) to return to the main screen.



09 The transmitter may now be turned off.



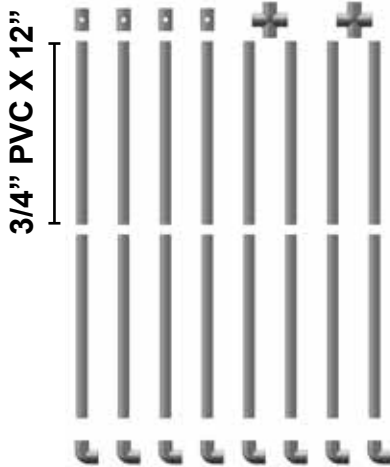
Final Assembly & Mounting on Rack



01

Assemble the PID test rack as shown below.

The frame of the PID test rack is made from PVC pipe.



These pipes assemble to make the completed rack.

After the rack is assembled the Velcro for the battery attachment and the propellers need to be added to the drone.

DO NOT CONNECT THE BATTERY PLUG UNTIL AFTER THE DRONE IS ON THE RACK!

02

Attach the provided Velcro (loop side) to the places shown in blue. They will be used to secure the battery.



VELCRO LOOP

03

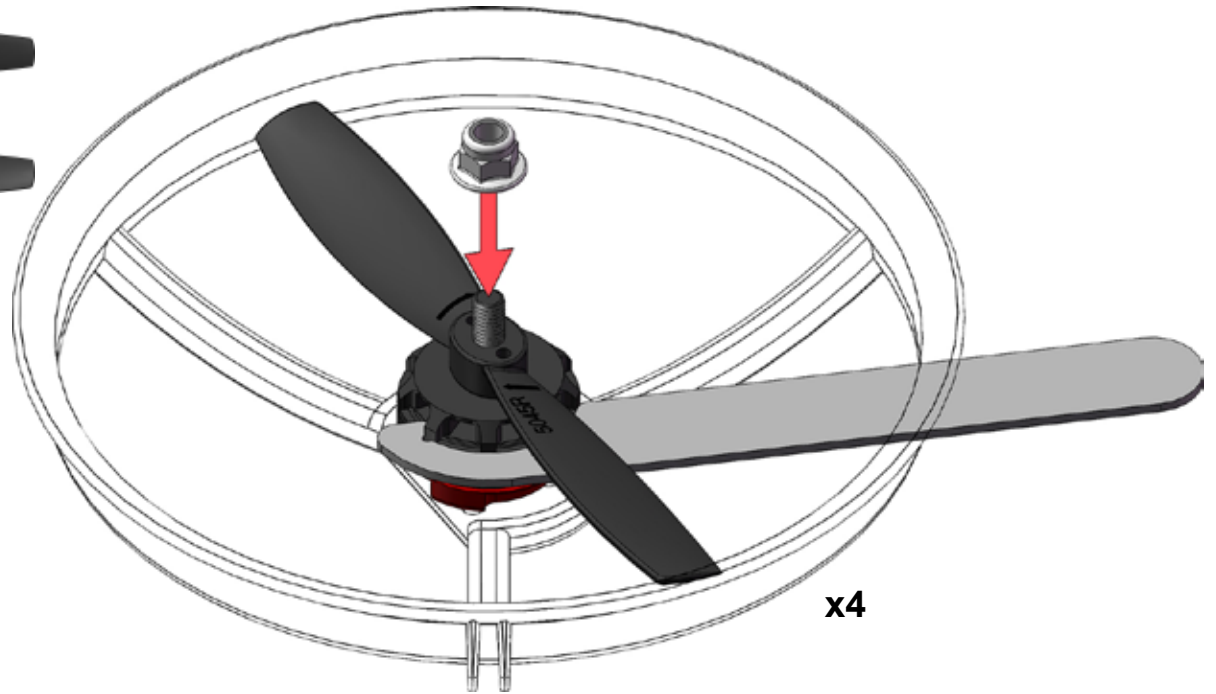
Attach the mating Velcro (hook side) to the battery. The battery should be centered on the frame then strapped in.

LEAVE THE BATTERY UNPLUGGED!!!



04

Using the spanner wrench to hold the motors while tightening the nylon lock nuts down. Pay careful attention to the direction of rotation for the propellers.



05

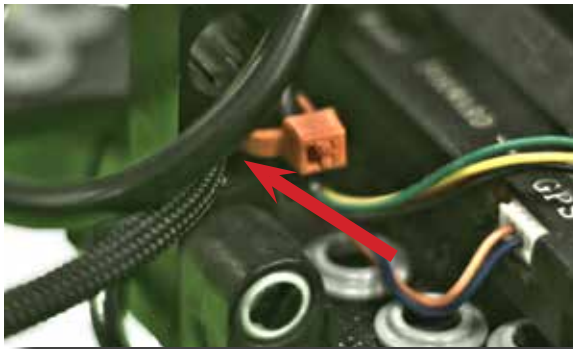
Attach the Parachute Cord to the Drone.



01 Find the two strings of parachute cord included with the kit:



02.a For drones with the GPS and Telemetry stands, loop the parachute cords through the GPS and Telemetry stands. If the drone does not have these stands perform step b instead.



Loop one of the parachute cords through the lowest open hole on the GPS stand (if incl.).

Loop the other parachute cord through the lowest open hole on the telemetry radio stand (if incl.).

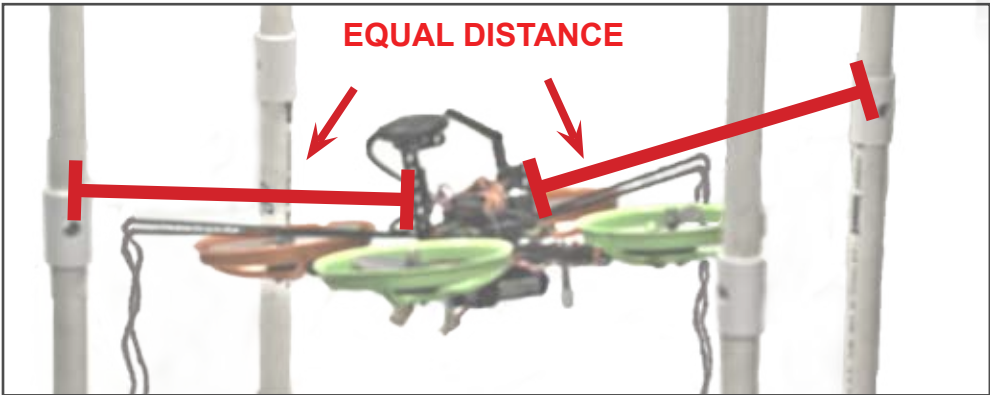


02.b For drones WITHOUT the GPS/telemetry stands, loop through two holes in body. Do this for each side.

06

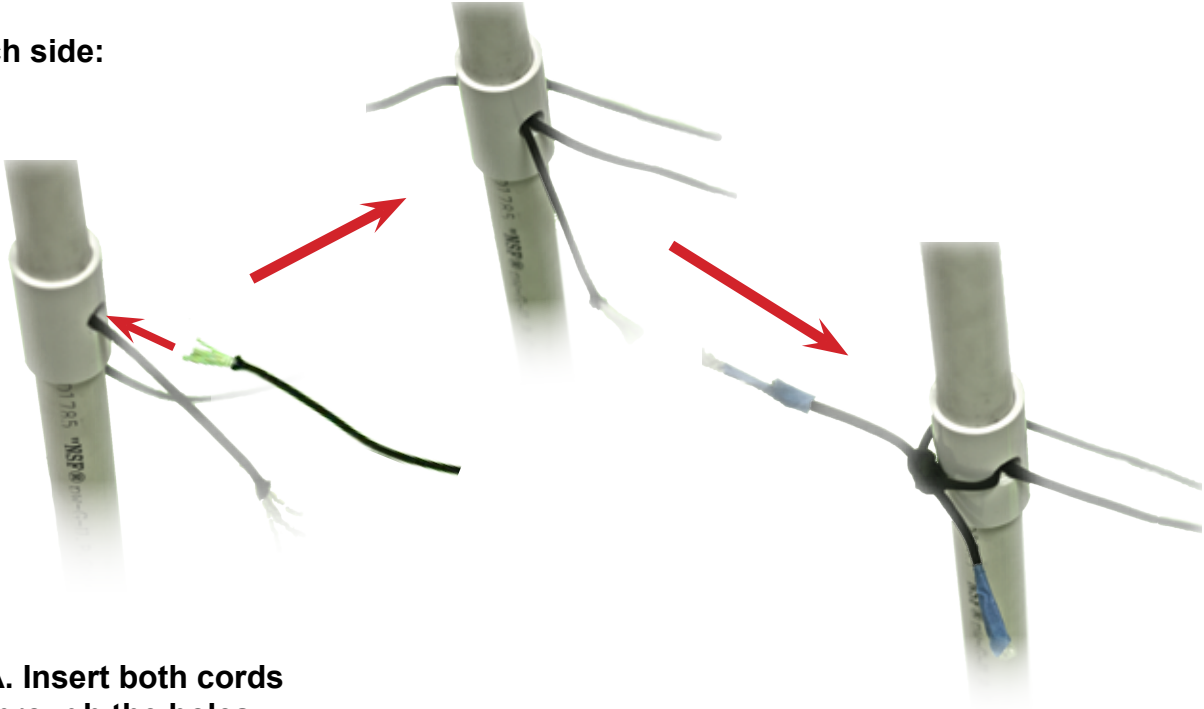
Attach the Drone to the Rack.

01 Have a student hold the drone roughly centered in the middle of the rack.



02 Have a second student secure the ends of the parachute cord to the posts on opposite sides of the drone.

For each side:



A. Insert both cords through the holes.

B. Tie off securely.

Preflight Testing on Rack

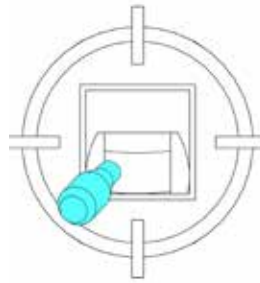


07

Put on safety glasses and have everyone not involved in the testing move well away from the rack. **MAKE CERTAIN THE DRONE IS SECURED TO THE RACK.**



EMERGENCY MOTOR SHUTDOWN IS:



Hold: Bottom LEFT Throttle

08

Begin the test...

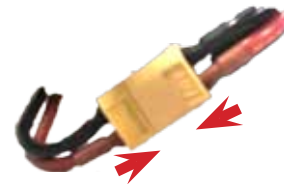
01

Put the throttle all the way down and turn on the transmitter.



02

Plug in the battery on the drone.

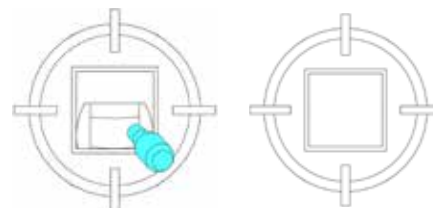


03

If the drone is swinging wait for it to stop. The drone will not arm if it is swinging. **STAND BACK A SAFE DISTANCE AND MAKE SURE THE TOP OF THE DRONE IS NOT TOWARDS ANYONE.**

04

Arm the UAV by moving the throttle to the bottom right and holding it until the motors start spinning. **NEVER EXCEED 50% THROTTLE WHILE THE DRONE IS ON THE RACK.**



09

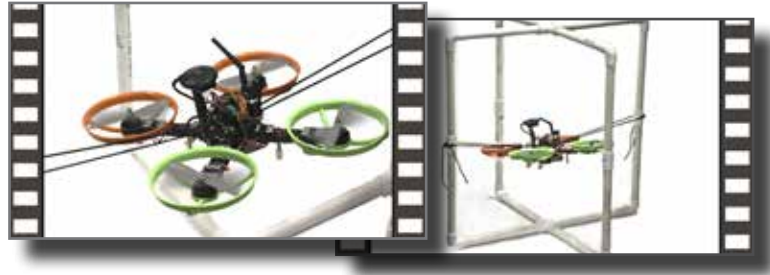
Check for stability.

Move the throttle (left stick) up to 25%. The drone should level out with limited vibration.

See:

[mymindsline](https://www.youtube.com/channel/UCmymindsline)

on youtube®



IF THE DRONE VIBRATES SIGNIFICANTLY, OR DOES NOT LEVEL SEE TROUBLESHOOTING SECTION.

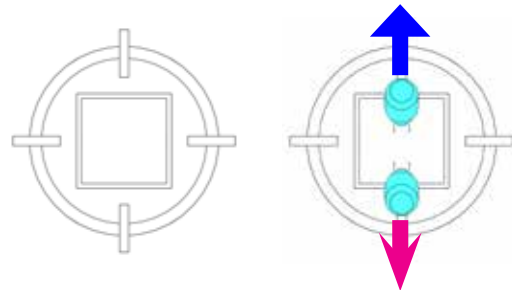
10

Check the pitch control.

With the throttle still at 25% or so, check the drone's movements in the pitch axis.

Check the pitch by moving the right stick slightly forward and backwards.

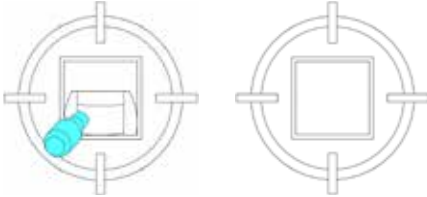
The drone should pitch down slightly when the stick is moved forward and pitch up slightly when the stick is moved backwards.



11

Test Shutdown & Failsafe.

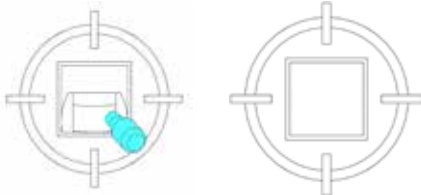
01 Put the throttle all the way down and to the left and hold to disarm the drone.



02 The propellers should stop after a few seconds. If the propellers do not stop contact customer service.



03 Restart the drone by holding down the stick to the bottom right.



04 Throttle the drone up to around 50% or until it is visibly pulling upwards on the cords.



05 Test the failsafe by cutting the transmitter signal. Open the back cover of the transmitter and remove one of the batteries.



06 After the battery is removed from the transmitter, the drone should visibly reduce throttle and come to rest hanging on the cables. **IF THE DRONE DOES NOT COME DOWN, CONTACT CUSTOMER SERVICE.**

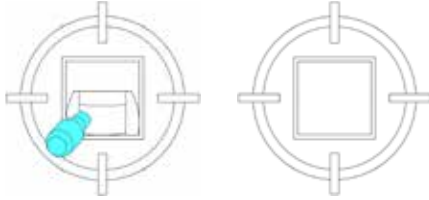


07 After the drone drops down, put the battery back into the transmitter and turn the transmitter on.

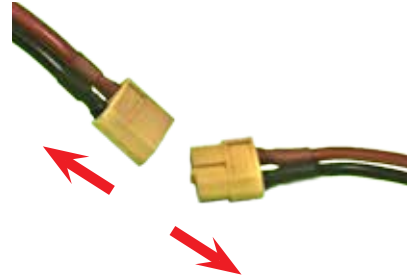
12

End the test...

01 If the props are still spinning, put the throttle all the way down and to the left and hold to disarm the drone.



02 After the props stop, unplug the battery on the drone.



03 Turn off the transmitter.



04 If the test was successful the drone may now be removed from the rack.

IF THE DRONE FAILED ANY OF THE TESTS, SEE THE TROUBLESHOOTING SECTION AT THE END OF THIS GUIDE.

DO NOT FLY!!!

Preflight Checklist & Flight



01

Preflight Safety Checklist



Wear Safety Glasses



Make certain the safety ducts are on the drone



Make certain nothing is broken, no wires are loose and the battery, and other parts, are firmly secured.



Move well away from the drone before arming it. Do not allow bystanders in the area!!!



NEVER FLY THE DRONE ABOVE OR NEAR PEOPLE INCLUDING OPERATOR!!!



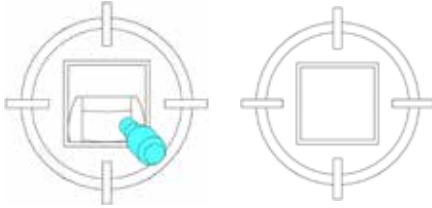
Obey all applicable FAA rules and regulations when flying outdoors.

02

Preflight Controls Check

01

Set the drone on a flat smooth surface. Follow the “Preflight Safety Checklist”. Turn on the transmitter, plug in the drone’s battery and arm the drone.



02

Increase the throttle GRADUALLY just enough that the drone tilts when the right stick is moved, but NOT enough that it takes off.

See:

[mymindsinc](https://www.youtube.com/watch?v=9mYm1n1n1n1)

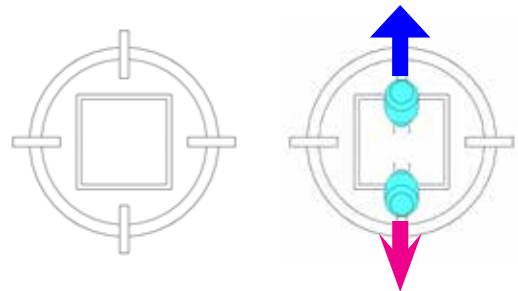
on youtube®



03

Check the pitch by moving the right stick slightly forward and backwards.

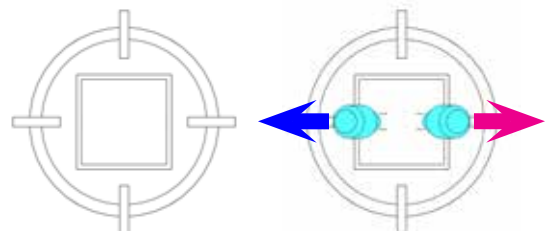
The drone should pitch down slightly when the stick is moved forward and pitch up slightly when the stick is moved backwards.



04

Check the roll by moving the right stick slightly right and left.

The drone should roll slightly to the right and left respectively as the stick is moved.



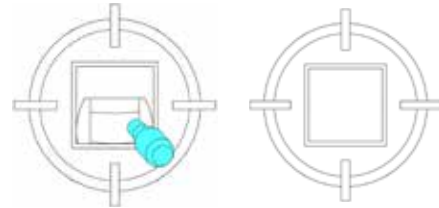
03

Flight

01 Follow the “Preflight Safety Checklist”

02 Wearing safety glasses, turn the transmitter on, then plug the battery into the drone.

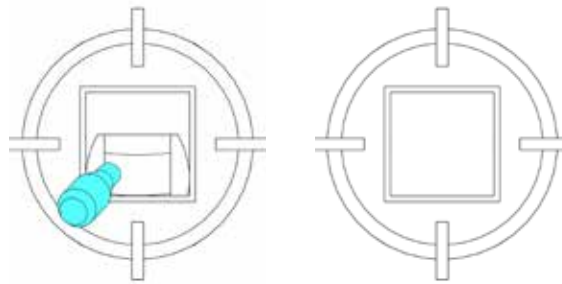
03 With everyone well clear of the drone, arm the drone.



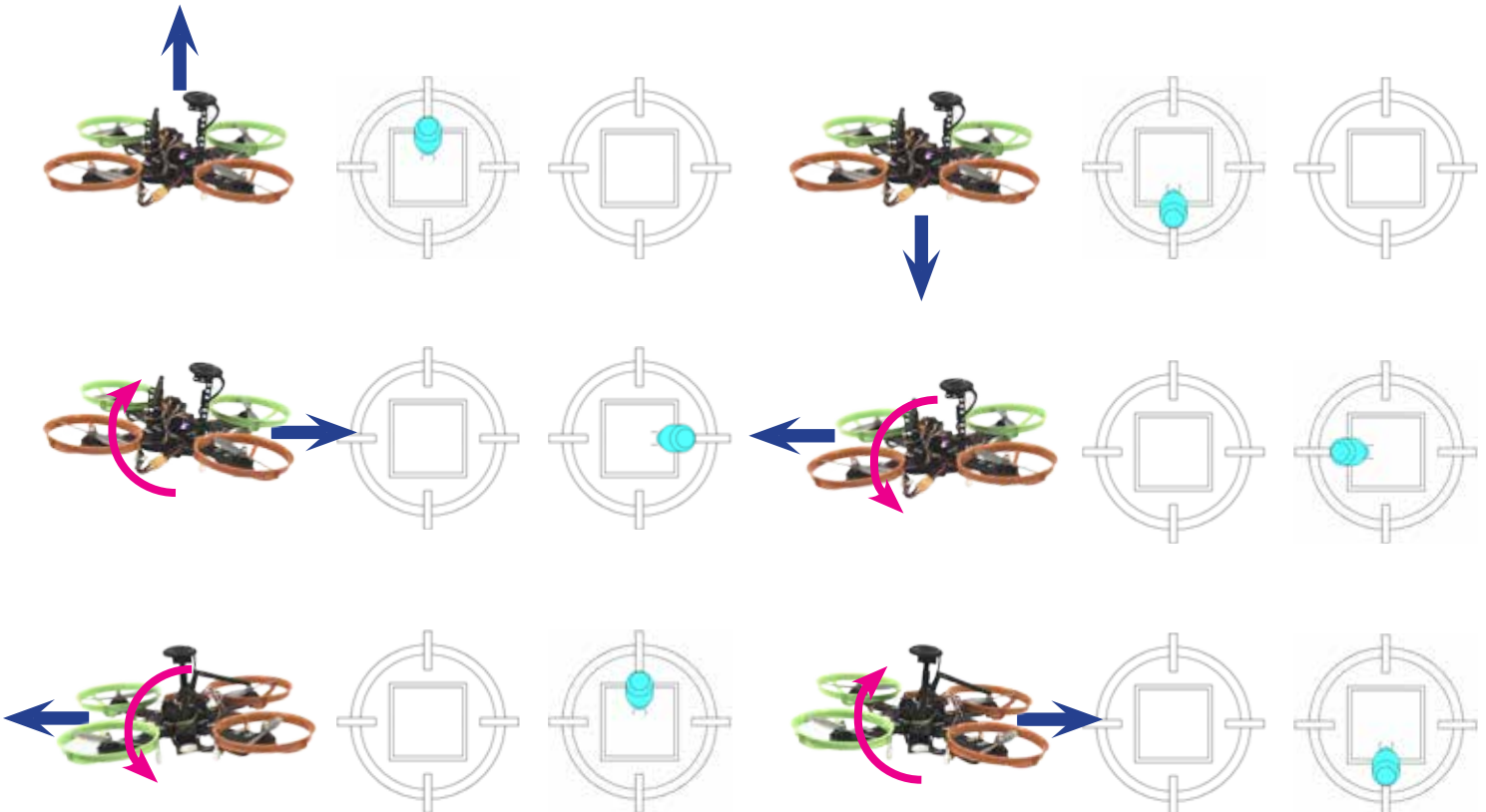
REMEMBER

EMERGENCY SHUT OFF IS: DOWN LEFT THROTTLE

This is also disarm.



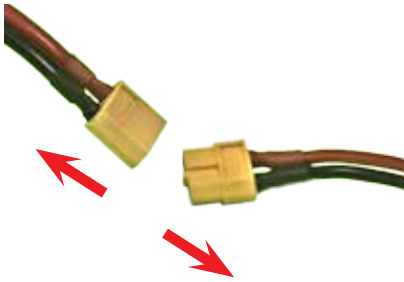
Controls:



04

Post Flight

01 Disconnect the battery from the drone.



02 Turn off the radio **AFTER** the battery is disconnected.



03 The drone will autoland if the battery voltage drops too low. **RE-ARMING AND FLYING THE DRONE AFTER AN AUTOLAND CAN DAMAGE THE BATTERY. DAMAGED BATTERIES CAN CATCH FIRE/EXPLODE IF CHARGED!!!**



Troubleshooting

UNPLUG BATTERY BEFORE HANDLING DRONE!



Drone won't arm (props won't spin.)

Possible Cause

- Not waiting long enough for arm
- Transmitter is off (no menu screen visible)
- Battery is not fully charged (or dead)
- Battery on drone not connected
- Time out

- Yaw axis swapped (Drone will arm when stick is in bottom LEFT position instead of bottom RIGHT position).

Solution

- Count to 15 sec before releasing stick
- Turn the transmitter on
- Swap battery for fully charged battery
- Connect the battery
- Disconnect the battery, turn the transmitter off then back on. Try again.
- Make certain that the radio is set correctly. **Check that the failsafe is set as described by pg38 step 20!** Then follow pg40.

REMOVE PROPELLERS BEFORE TRYING THE BELOW

- Transmitter is not bound: (RX) battery indicator on screen shows a "?".
 - Software flight check failed (ex. compass "HMC5883L" problem).
 - Software not loaded correctly or battery was unplugged too soon during step 3 of the "Flight Controller Programming".
 - Sensor calibration: step 2 of "Flight Controller Programming" was not performed or not completed.
 - Bad or loose wiring / connections.
- Reset the transmitter following the steps from page 36 onward. **Make certain that the failsafe is set (pg38 step20)!**
 - Update all software to most current version. If instructed, or if external GPS was not provided, follow the instructions on pg26.
 - Reset the software on the drone by performing steps 3 & 4 of the "Flight Controller Programming" section again. Wait the full 40 seconds after plugging in the battery for step 3.
 - Starting with step 1 perform ALL steps in the section "Flight Controller Programming" in sequence listed.
 - Check that the drone is wired correctly and that the power module is connected firmly. Check that the ESC's are not damaged or loose.



Drone vibrates excessively, flips when tested on rack, or does not respond correctly to controls.

Possible Cause

- Loose components.
- Propellers are installed on the wrong hubs.
- ESC's/motors are mounted on the wrong arms.

Solution

- Check that the propellers are firmly secured by the nuts. Check that all connectors on the frame are secure. Check that the battery is firmly secured to the frame.
- Check that the clockwise propellers are mounted on the clockwise motors and the counter-clockwise propellers are mounted on the counter-clockwise motors.
- Flip the drone over and look at the "CW"/"CCW" labels on the ESC's. Each diagonal should have a pair. See step 5 of the "UAV Airframe Build".

REMOVE PROPELLERS BEFORE TRYING THE BELOW

- Bad PID tuning in software.
- ESC's/motors are wired to the wrong pins on the Flight Controller.

- Update to latest software version of Minds-i-Drone libraries and repeat step 4 of "Flight Controller Programming".
- Take the drone apart and check that the wiring matches steps 5,9 & 17 in the "UAV Airframe Build".



Drone won't level or tilts/drifts severely during flight.

Possible Cause

- Flight controller is mounted at a angle, and/or was not calibrated since mounting.

Solution

- **REMOVE PROPS**, redo the "Programming Flight Controller" section starting with step 1.



Drone's flight is stable but it does not respond correctly to controls.

Possible Cause

- Radio channels are not reversed properly
- Old version of the "quadcopter" sketch where pitch and roll are reversed.

Solution

- Check the radio menus from "Setup the Transmitter".
- Update to latest version of software.



Drone won't take off.

Possible Cause

- Low battery voltage
- Wrong flight mode.

- Wrong minimum voltage value in the software.

Solution

- Swap out battery with fully charge battery
- Unplug the drone's battery. Turn the transmitter off and on again following pg35. Retry arm & fly.
- Update to latest version of the Minds-i-Drone library. **REMOVE PROPS** & repeat step 4 of "Flight Controller Programming".



CalibrateSensors fails during "Flight Controller Programming".

Possible Cause

- Compass problem (HMC5883L error) due to new GPS module using clone.
- Compass problem (HMC5883L error) due to no GPS module.
- USB connection problem: Scrolling values in "Serial Monitor" stop without any other message.

Solution

- Update to latest software version of Minds-i-Drone libraries and reload CalibrateSensors. Retry...
- Follow the steps on pg26 to use the internal compass with the jumper.
- Unplug the USB cable & plug it back in. Then redo step 2. Preferably use a new USB cable if problem persists.



Problems do not resolve or other problem.

Contact Customer Service

- Email: info@my minds i.com
-
- Phone: (509) 252-5767
-
- Web: mindsieducation.com

D R O N E S

MINDS-i

STEM INTEGRATED ROBOTICS

MINDS-i Dashboard

The screenshot displays the MINDS-i dashboard interface. The main background is a satellite map of North America. On the left side, there is a vertical control panel with the following elements:

- Configuration** button
- elevation** button with '+' and '-' buttons below it
- Telemetry** button
- Graph** button
- Event Log** button
- Robot** selector with left and right arrow buttons
- Input fields for **Lat: 0.0**, **Lng: 0.0**, and **Alt: 0.0**
- New** and **Enter** buttons
- Save** and **Load** buttons
- Set Target** button
- Looping On** button

At the top center of the map area, there are **Refresh** and **Connect** buttons. On the right side, there are several data readouts and status indicators:

- A small data panel showing: **Yaw: 0.0**, **Roll: 0.0**, **Pitch: 0.0**, **Roll: 0.0**, **Roll: 0.0**, **Roll: 0.0**, **Vcc: 0.0**
- A panel showing: **Alt: 0**, **Sea: 0**, **Mph: 0.0**, **Vcc: 0.0**
- Four circular icons representing different robot configurations: a 2-wheeled robot, a 4-wheeled robot, a 4-wheeled robot with a camera, and a 4-wheeled robot with a camera and a sensor.
- A **Radio Status** panel with a progress bar and two small maps.


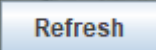

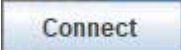
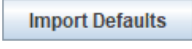
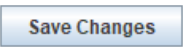
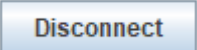
At the bottom center of the map, there is a **Welcome!** message.

Connecting to the Dashboard:

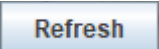


First time only:

- Follow the setup instructions in the MINDS-i Drone Library repository for your drone
- Make sure appropriate drivers are available for your telemetry radios
 - If you are running windows, a driver installation button is available in the configuration menu. Other operating systems frequently work without modification.
- Configure your Telemetry Radios

Telemetry Radio Configuration

- Make sure appropriate drivers are available
- Start the dashboard and open the  window
- Plug the telemetry radio into the computer with the USB cable
- Click , Select  and  to the telemetry radio Radios will come with a default of 56700 baud, but after configuration they will connect at 9600 baud
- Make the changes you want, or press  to automatically configure it for use with MINDS-i drones
- Press , , and power cycle the telemetry radio
- Remember to update the settings on both the sending and receiving telemetry radios

Each Flight / Drive:

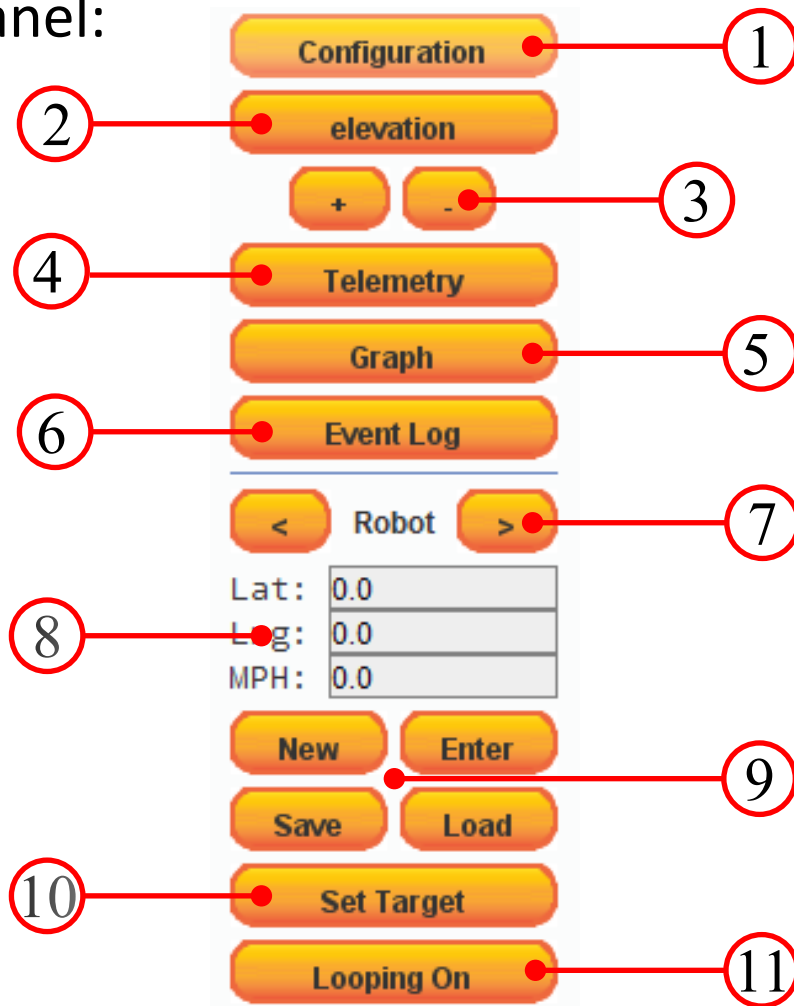
- Connect the telemetry radio to the computer
- Turn on your drone
- Press  in the dashboard window connection tray
- Select the appropriate serial  device from the drop-down
- Press 
- You should start seeing telemetry from your drone arrive shortly. Waypoints you have already entered will be sent to the drone, and the settings stored on board will be loaded so they can be changed in the telemetry window.

Dashboard Features & Functions

The screenshot shows the MINDS-i dashboard interface. The main area is a map of Liberty Lake, Idaho, with labels for 'Pumphouse Park', 'Meadow Golf Co', and 'LIBERTY LAKE'. The interface is divided into several functional panels:

- Waypoint Panel:** Located on the left side, enclosed in a red box. It contains a 'Configuration' button, a 'satellite' button with '+' and '-' controls, 'Telemetry', 'Graph', and 'Event Log' buttons. Below these are 'Robot' controls with '<' and '>' arrows, and input fields for 'Lat: 0.0', 'Lng: 0.0', and 'Alt: 0.0'. At the bottom are 'New', 'Enter', 'Save', 'Load', 'Set Target', and 'Looping On' buttons.
- Connection Panel:** Located at the top center, enclosed in an orange box. It features a 'Refresh' button, a dropdown menu, and a 'Connect' button.
- Data Panel:** Located on the right side, enclosed in a blue box. It displays flight statistics: 'Alt: 0', 'Sea: 0', 'Mph: 0.0', and 'Vcc: 0.0'. Below the statistics is a circular drone icon, a battery level indicator, and a 'Radio Status' section with two status indicators.
- Terminal:** Located at the bottom center, enclosed in a green box. It displays the text 'Welcome!'.

Waypoint Panel:



1. Configuration: Opens a pop up window with the Telemetry Radio Configuration tool.
2. View Button: This button switches the map between satellite and elevation views.
3. Navigation: Zoom in and out.
4. Telemetry: Opens a window allowing you to select the information that will be recorded in the log as well as all of the adjustable settings for the vehicle.
5. Graph: Opens a pop up window with a live data graphing function.
6. Event Log: Opens up the log for the active session.
7. Waypoint selector: moves the selection up and down the list of waypoints.
8. Waypoint entry: Will be filled with the latitude, longitude and altitude (MultiRotor) or speed (UGV) of selected waypoint. You can also edit the waypoint location information.
9. New & Enter, Save & Load: Used to create save and load the GPS waypoint list as a .gpx file.
10. "Set target": Click set target to redirect the robot to the selected waypoint.
11. Looping Button: Toggles whether or not the robot will stop when it reaches the last waypoint or if it will loop around and drive to the first and on from there.

Configuration:

The screenshot shows the 'Configuration' window of the MINDS-i Dashboard. At the top left, there is a sidebar with buttons for 'elevation', 'Telemetry', 'Graph', 'Event Log', and 'Robot'. Below these are fields for 'Lat: 0.0', 'Lng: 0.0', and 'MPH: 0.0', along with buttons for 'New', 'Enter', 'Save', 'Load', 'Set Target', and 'Looping On'. The main window has a title bar 'Configuration' and contains several buttons: 'Toggle ground/air mode' (1), 'Launch driver installer' (2), 'Refresh' (3), a dropdown menu for 'COM' (4) currently showing 'COM100', a dropdown for '9600' (5), and a 'Connect' button (6). Below these is a table with columns 'ID', 'Name', and 'Value' (7). At the bottom of the window are 'Import Defaults' (8) and 'Save Changes' (9) buttons. The footer of the window reads 'MINDS-i Dashboard | Version 1.0.0 | 2016-12-28' and includes map data attribution.

1. Toggle ground/air mode: Switches between ground and air mode.
2. Driver Installer: Launches the installer for the radio driver.
3. Refresh: Refreshes the serial port list.
4. Com Port List: Shows the open com ports.
5. Baud Rate: Used to set the communication speed.
6. Connect: Connects to the telemetry radio to adjust the settings.
7. Settings Window: Shows all of the radio settings.
8. Import Defaults: Allows you to set all of the options back to default.
9. Save Changes: Saves any settings you have changed.



Telemetry:

Configuration
elevation
+ -
Telemetry
Graph
Event Log
< Robot >
Lat: 0.0
Lng: 0.0
MPH: 0.0
New Enter
Save Load
Set Target
Looping On

The screenshot shows a 'Telemetry' window with a 'Set logging period (ms)' field set to 250. Below this are two tables. The first table lists data points with their current values. The second table lists various settings with their current values. At the bottom, there is a section for setting limits and a descriptive text for the logging period.

name	Value
Latitude	0.0
Longitude	0.0
Yaw/Direction	0.0
Pitch	0.0
Roll	0.0
Ground Speed	0.0
Voltage	0.0

name	Setting
Output Period	0.0
Accel Gain	0.0
Mag Gain	0.0
Att P Term	0.0
Att I Term	0.0
Att D Term	0.0
Att VP Term	0.0
Att VI Term	0.0
Att VD Term	0.0
Yaw P Term	0.0
Yaw I Term	0.0
Yaw D Term	0.0
Yaw VP Term	0.0
Yaw VI Term	0.0
Yaw VD Term	0.0
Hover Throttle	0.0
Throttle Linearity	0.0

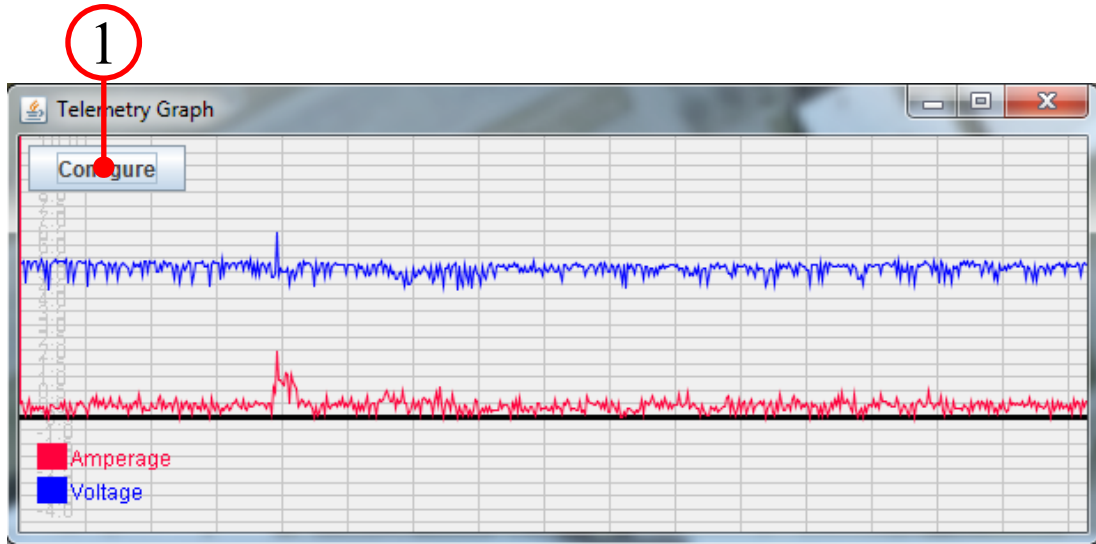
min: 5000.0 max: 10000.0 default: 6666.0

Period in milliseconds between reading the imu, calculating orientation, and sending a signal to the ESC's
This value should be between 5000 (200Hz) and 10000(100Hz)
Higher speeds will decrease the processing time left for other tasks, but could lead to a more stable flight

1. Data Log Window: The data log opens in a new window.
2. ID Column: Lists the names of the preset data to be logged as well as the open slots.
3. Value Column: Includes the value for each row of data.
4. Data Log Interval: Period of time between saving data.
5. Setting Names
6. Setting Value: Used definable settings, used to adjust performance
7. Setting limits: Shows operator the minimum, maximum and default value for each setting.
8. Setting Description: Describes what each setting adjusts.

Graph:

Configuration
elevation
+ -
Telemetry
Graph
Event Log
< Robot >
Lat: 0.0
Lng: 0.0
MPH: 0.0
New Enter
Save Load
Set Target
Looping On



The Graph Configuration window contains several settings and a data table. At the top, there are sliders for Y Scale (40), Y Center (0), and X Scale (1). Below these are checkboxes for AntiAlias (checked) and Graph?. A table lists various data points with checkboxes for each. At the bottom, there is a color palette and a 'Recent' section.

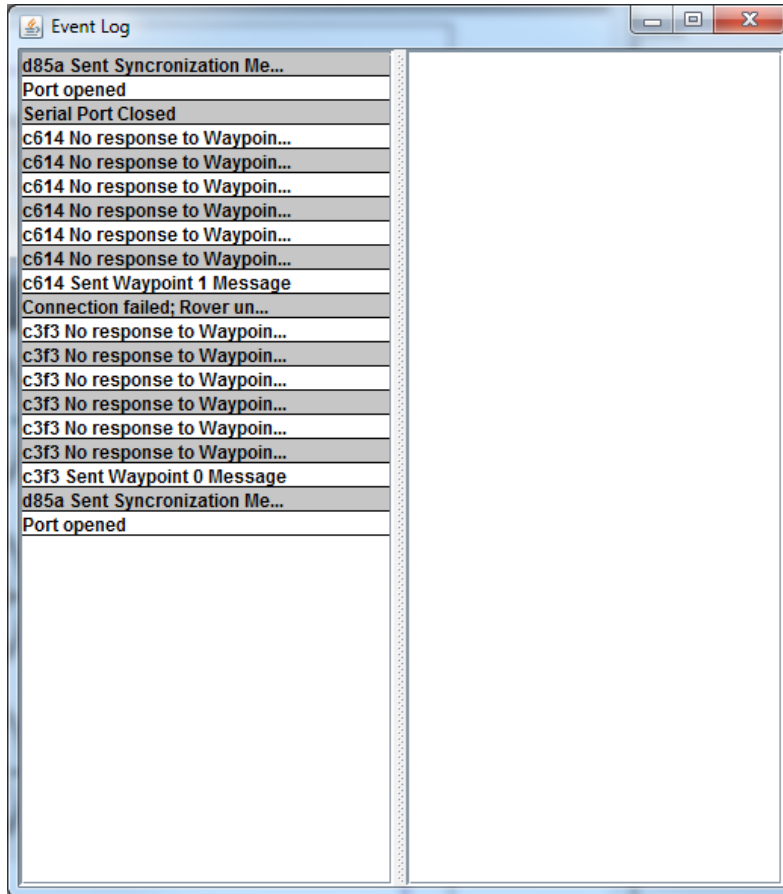
#	Graph?
Latitude	<input type="checkbox"/>
Longitude	<input type="checkbox"/>
Yaw/Direction	<input type="checkbox"/>
Pitch	<input type="checkbox"/>
Roll	<input type="checkbox"/>
Ground Speed	<input type="checkbox"/>
Voltage	<input type="checkbox"/>
Amperage	<input type="checkbox"/>

1. Configure: Opens Graph Configuration.
2. Anti Alias: Used to smooth jagged edges on curved lines and diagonals.
3. Scaling: Adjusts the scale of the graph.
4. Data Name
5. Check Box: User input for the data to be graphed.
6. Color Settings: User selected color for each row of data selected.

Select the check box in the row of the data desired to be graphed then select the color you would like the line to be on the graph, repeat for each row of data.

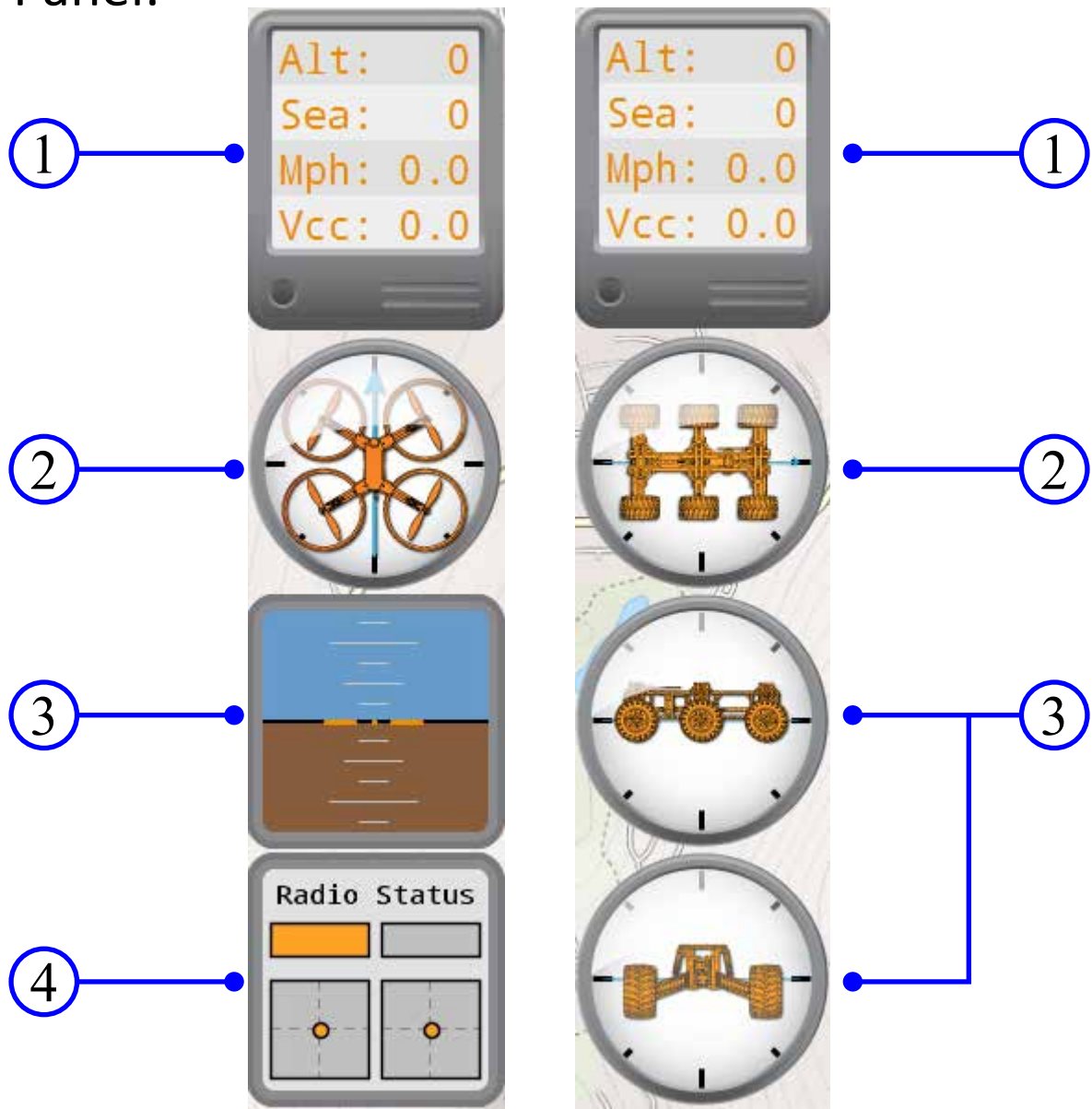
Event Log:

Configuration
elevation
+ -
Telemetry
Graph
Event Log
< Robot >
Lat: 0.0
Lng: 0.0
MPH: 0.0
New Enter
Save Load
Set Target
Looping On



1. Event Log: Lists all attempts of communication between the vehicle and the Dashboard software (successful or not).

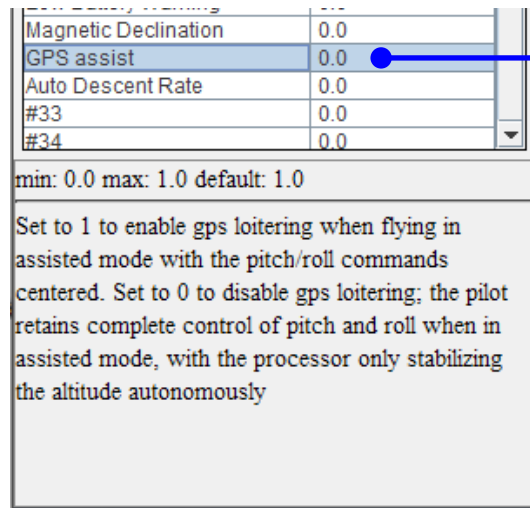
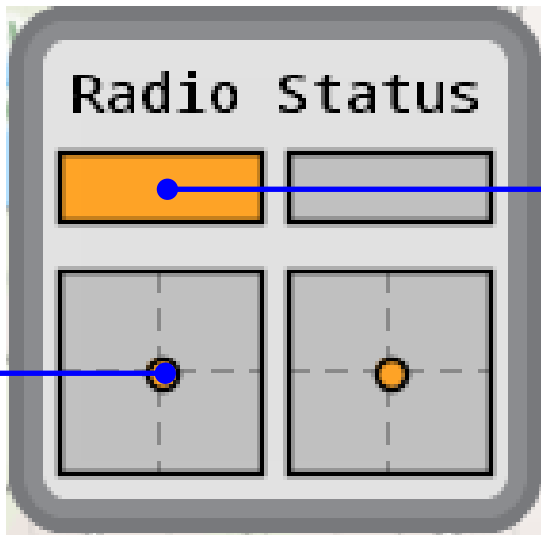
Data Panel:



Data from the robot will populate this panel when connected. A lack of data when connected could indicate a failing connection to the robot, possibly from distance or obstacles blocking the signal.

- ① Altitude (Above Ground), Altitude (Sea Level), Speed (MPH), Battery Voltage (Vcc).
- ② Vehicle Direction (compass heading)
- ③ Vehicle Pitch & Roll (front to back tilt & side to side tilt)
- ④ Radio Status (current position of control sticks)

Flight Modes:



1. Stick Movements: This will show you how the inputs from the radio are being received by the arduino code. You will want to make sure that the stick movements of your controller match the movements of the orange dots. If their movements don't match you will need to either reverse the channel or double check that you have correctly connected the radio receiver to the flight controller.

2. Flight Mode Indicator: This will toggle between the left and right boxes to indicate if the MultiRotor is in Stabilize or Altitude Hold. The box highlighted orange indicates the current flight mode.

A. Stabilize: Maintains level flight only.



A



B. Altitude Hold: Maintains level flight and holds altitude.

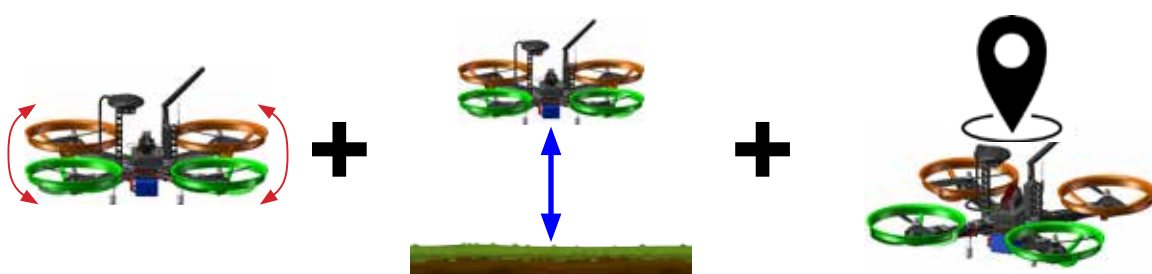


B

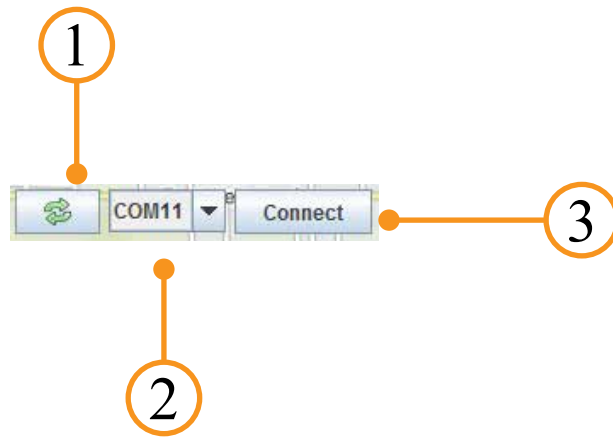


3. GPS Assist (Loiter Mode): Setting this value to 1 will replace Altitude Hold with Loiter Mode. The MultiRotor will hold latitude and longitude while you aren't moving the right stick on the remote.

C. Loiter Mode: Maintains level flight, holds altitude and GPS position.



Connection Panel:



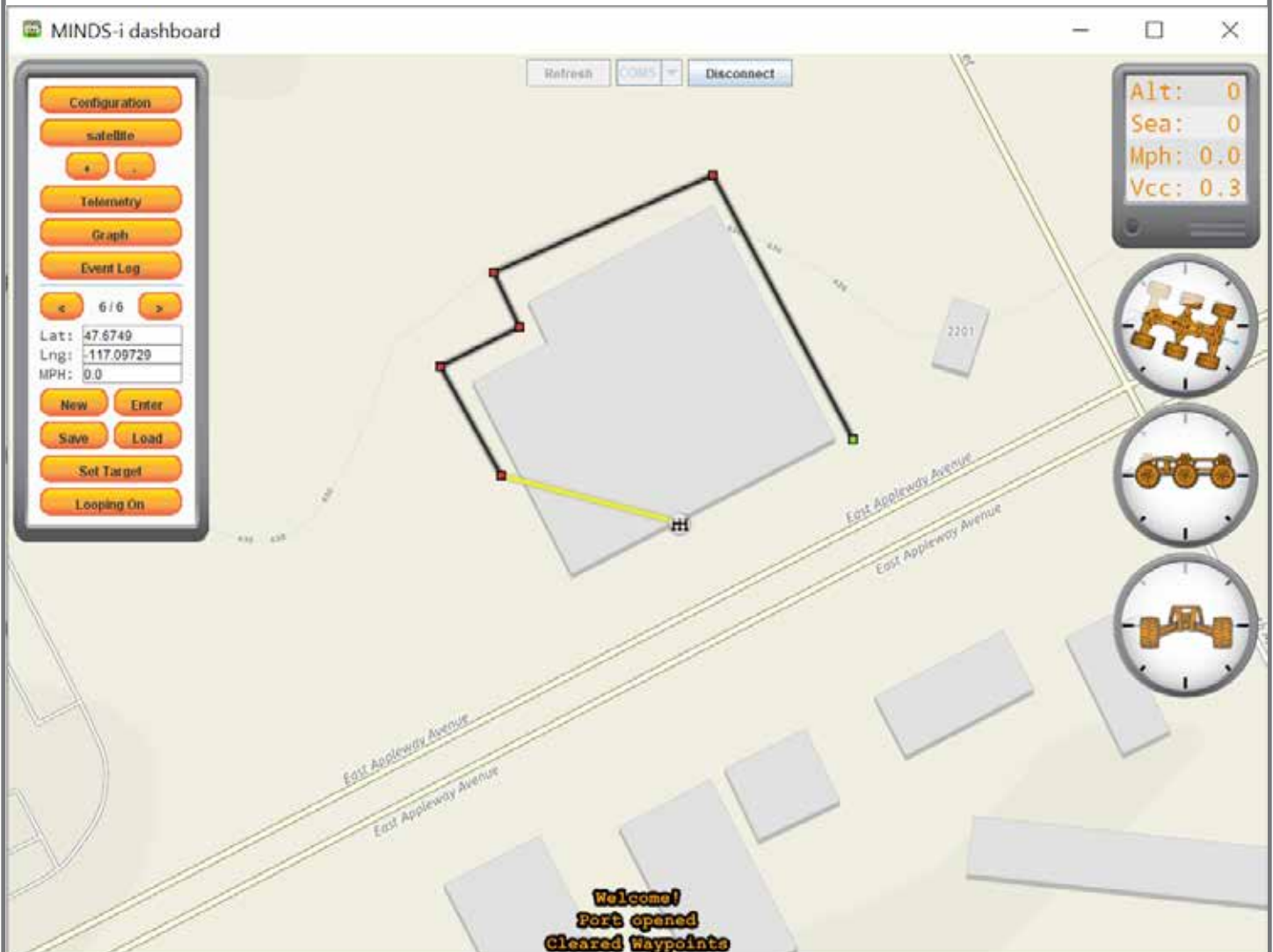
1. The refresh button will repopulate the drop down menu with the currently available serial ports
2. To connect, select the appropriate serial port in the drop down and press connect.
3. When a connection has been established, the "Connect" button will change to say "Disconnect"





Terminal:



- The terminal will display status updates of the communication messages.
- If the dash is forced to give up on a message it will inform you which message did not make it to the robot.
- Malformed or misunderstood messages coming from the robot are signs of a failing connection but not themselves cause for worry.

Map View:



-  The rover will automatically be placed on the map where the GPS indicates it is located
- Click and drag on the map to pan your view
- Scroll on the map or click the   to zoom
- Click on any empty part of the map to add a waypoint to the end of the current path
- Click on any waypoint to select it. The current waypoint will be green 
- Click on a path to “break” it and add a waypoint in the middle
- Right click on a waypoint to remove it from the path
- Click a waypoint and drag to reposition it
- The Yellow line is the direct path from the Drones current location to the next waypoint.

Switching Between Ground and Air Mode

To switch the dashboard between ground drone and air drone mode, Open the configuration window, press “Toggle ground/air mode”, and then restart the dashboard

Artificial Horizon

When in air mode, the artificial horizon widget can be clicked on to open a full size window with altitude and heading overlaid on the right and top edge respectively.

Waypoint Targeting

When in ground mode, clicking the map will place a GPS waypoint at that location that a connected rover will attempt to drive to. To add a waypoint at the end of the path, click on the map. Click on an existing path’s line to “break” it and add a new point in-between. Right click on a point to delete that waypoint

Log Files

The dashboard makes a .log and a .telem file in the log directory each time its run.

.log files contain a record of errors, warnings, and messages received from the robot while its running.

.telem files contain the robots telemetry data storing in CSV format with the first column containing the timestamp that data was stored at, and the remaining columns being each index of telemetry in order.

The frequency that received telemetry is logged can be changed in the telemetry window, accessible from the left navigation box in the dashboard.



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