



Aircraft Flight Manual

RDASS HD



Part # 27670003
Revision 07-17-2017

Table of Contents

1.	Introduction	1
1.1	Documentation Conventions	1
1.2	Abbreviations and Terms	2
1.3	Notes, Cautions, and Warnings.....	4
2.	RDASS System Description	7
2.1	List of Components	7
2.2	DX9 Radio Controller Switchology	12
2.3	HD Video Monitor	16
3.	PC Ground Control Station.....	17
3.1	Ground Control Station Components	17
3.2	Ground Control Station Procedures.....	17
3.2.1	Link Ground Control Station to the Aircraft	17
3.2.2	Create a Flight Plan Using Photogrammetry Tool	18
3.2.3	Create a Flight Plan Using a Template	18
3.2.4	Edit, Save, and Recall a Flight Plan	20
4.	Battery Procedures	21
4.1	Battery Safety.....	21
4.2	Charging the Radio Controller.....	23
4.3	Charging the GoPro	24
4.4	Testing LiPo Battery Voltage	24
4.5	Charging Sony α6000 Battery	24
4.6	Charging LiPo Flight Batteries	25
4.7	Charging the Video Monitor	26
4.8	LiPo Battery Storage Procedures	27
5.	Cameras	28

5.1 GoPro Hero4	28
5.1.1 Common GoPro Operations	29
5.1.2 Take Time Lapse Photos.....	29
5.1.3 GoPro Camera Specifications.....	29
5.1.4 GoPro Hero4 Menus	30
5.1.5 GoPro Status Screen.....	31
5.2 FLIR Vue and FLIR Vue Pro	32
5.2.1 FLIR Vue and FLIR Vue Pro Specifications	32
5.3 Sony α6000	33
5.3.1 Sony α6000 Camera Specifications.....	34
5.4 MicaSense RedEdge	35
5.4.1 MicaSense RedEdge Camera Specifications.....	35
5.5 Additional Ethernet Out.....	36
6. GeoReferencer	37
6.1 GeoReferencer Components	37
6.2 Configuring the GeoReferencer	37
7. Flight Procedures	39
7.1 Course Lock Procedure	39
7.2 Point of Interest Procedure.....	40
7.3 Go-Home Procedure	41
7.4 Remote Control Take Back Procedure	42
7.5 Camera Selection	43
7.6 Gyro-Stabilized Gimbal Initialization.....	43
7.7 Operating the Navigation Lights	43
8. HD Flight Checklist	44
8.1 Crew Brief.....	46

8.2	LED Autopilot Status Lights	47
9.	Performance and Limits	49
9.1	Aircraft Specifications	49
9.2	Flight Time Calculation	49
10.	User-Level Maintenance	50
10.1	Rotor Removal	50
10.2	Rotor Installation	51
10.3	Compass Calibration	52
10.4	IMU Calibration	53

1. INTRODUCTION

Congratulations on your purchase of the Leptron RDASS. The Leptron RDASS offers a superior aerial data collection platform. Leptron provides this manual to support safe, effective, and legal operations of our small Unmanned Aircraft System (sUAS). You can ensure that you are getting the maximum benefit from your sUAS by strictly observing all operating procedures and practices outlined in this manual. You should regularly check leptron.com for updates to this manual, as this manual is subject to change without notice.

1.1 Documentation Conventions

 NOTE	An operating procedure, condition, etc., which is essential to highlight.
 CAUTION	An operating procedure, practice, etc. which, if not strictly observed, could result in damage to or destruction of equipment.
 WARNING	An operating procedure, practice, etc., which, if not correctly followed, could result in personal injury or loss of life.
SHALL:	Used to indicate a mandatory requirement
WILL:	Used to express a declaration of purpose
SHOULD:	Used to indicate a nonmandatory but preferred method of accomplishment
MAY:	Used to indicate an acceptable method

1.2 Abbreviations and Terms

(AGL) Above Ground Level	Altitude measured with respect to the ground surface. This is as opposed to altitude measured above mean sea level (MSL).
(ATC) Air Traffic Control	The ground-based personnel and equipment concerned with monitoring and controlling air traffic within a particular area.
(COA) Certificate of Waiver or Authorization	An authorization issued by the Air Traffic Organization to an operator for a specific unmanned aircraft activity.
(FOV) Field of View:	The area in front of a camera or sensor that can be observed instantaneously.
(FPV) First Person View	A method used to control a radio-controlled aircraft looking from the point of view of an on-board camera.
(FTF) Functional Test Flight:	A series of flight maneuvers used to verify functionality controllability of the aircraft and associated flight equipment throughout various flight regimes.
(IOC) Intelligent Orientation Control:	IOC modes consist of Course Lock (CL) and Point-of-Interest (POI). CL fixes the directional orientation of the aircraft in reference to the aircraft heading during boot-up. POI adjusts the aircraft heading to maintain a nose-in orientation on a recorded point.
(LiPo) Lithium Polymer:	A rechargeable battery consisting of a single or multiple cells containing lithium ion polymer chemistry.
(MTR) Military Training Route:	Aerial corridors across the United States in which military aircraft can operate below 10,000 feet faster than the maximum safe speed of 250 knots that all other aircraft are restricted to while operating below 10,000 feet.
Night	The time between the end of evening civil twilight and the beginning of morning civil twilight, as published in the Air Almanac, converted to local time.

(NOTAM) Notice to Airmen:	A written notification issued to pilots before a flight, advising them of circumstances relating to flying.
(PIC) Pilot in Command:	The person who has final authority and responsibility for the operation and safety of the flight; has been designated as PIC before the flight
(RDASS) Rapidly Deployable Aerial Surveillance System	A UAS designed to be easily transportable and rapidly deployable
(TFR) Temporary Flight Restriction:	An area restricted to flight due to a hazardous condition, a special event, or a general warning for the entire airspace.
(UA) Unmanned aircraft:	Any aircraft that is operated without the possibility of direct human intervention from within or on the aircraft
(UAS) Unmanned Aircraft System:	Unmanned aircraft and associated elements, including communication links and the components that control the unmanned aircraft, that are required for the PIC to operate safely and efficiently in the national airspace system
(VLOS) Visual Line of Sight:	Unaided (corrective lenses and/or sunglasses excepted) visual contact between a pilot in command and an unmanned aircraft sufficient to maintain safe operational control of the aircraft, know its location, and be able to scan the airspace in which it is operating to see and avoid other air traffic or objects aloft or on the ground
(VO) Visual Observer:	A person acting as a flightcrew member who assists the small UA remote PIC and the person manipulating the controls to see and avoid other air traffic or objects aloft or on the ground.

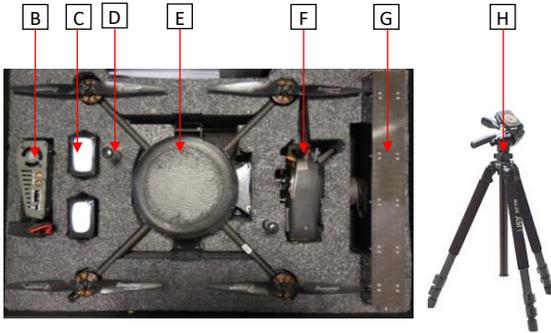
1.3 Notes, Cautions, and Warnings

 NOTE	<p>Read the entire manual before operating the RDASS.</p>
 NOTE	<p>This manual shall be immediately available to the operator at all times during operation of the RDASS. Check leptron.com regularly to ensure the most up-to-date version of this manual is used.</p>
 NOTE	<p>Always use the Flight Checklist provided herein during flight. For convenience, a laminated Flight Checklist (P/N: 27670006) is provided to meet this requirement.</p>
 NOTE	<p>Maintain a Pilot Log and an Aircraft Log (P/N: 27670002) for all flights. Additional log sheets are available on leptron.com (FAA 14 CFR 61.51 (b)).</p>
 NOTE	<p>Comply with all FAA (or similar aviation authority) and local regulations.</p>
 NOTE	<p>Before flying, check for Temporary Flight Restrictions (TFRs), Military Training Routes (MTRs), and Notice to Airmen (NOTAMs) that may affect your planned flight.</p>
 NOTE	<p>If you experience any issue not covered in this manual, please contact a Leptron Authorized Dealer. A list of dealers can be found at leptron.com.</p>
 CAUTION	<p>Do not fly within 500 feet below or within 2000 feet horizontally of any cloud.</p>
 CAUTION	<p>ONLY use Leptron provided propellers and batteries.</p>
 CAUTION	<p>Keep the compass module away from magnets including car speakers. Magnets can damage the compass and can cause the aircraft to lose control.</p>
 CAUTION	<p>Do not leave LiPo batteries in direct sunlight. This can reduce the life of the batteries.</p>

 CAUTION	<p>Do Not Expose LiPo batteries to temperatures below 20°F. The internal battery cells can freeze and rupture</p>
 CAUTION	<p>Store and ship batteries in accordance with local and federal laws</p>
 CAUTION	<p>Verify the WiFi function is disabled on GoPro to avoid interference with the Radio Controller, which may cause the RDASS to execute a Go-Home or become uncontrollable.</p>
 CAUTION	<p>Do not leave LiPo batteries unattended while charging. An undetected fault in the charger could cause a fire</p>
 CAUTION	<p>Visual Line of Sight SHALL be maintained at all times by either the PIC or VO</p>
 CAUTION	<p>Do not fly at night without red, green, and white navigation lights. Always follow FAA (or similar aviation authority) and local regulations when flying at night.</p>
 CAUTION	<p>Failure to install antennas can cause permanent damage to equipment . Always install antennas prior to powering any equipment that uses an antenna.</p>
 WARNING	<p>Flight within 5 nautical miles of any airport may require special permissions, a VHF 2-Way radio, and coordination with Air Traffic Control (ATC) a minimum of 24 hours in advance.</p>
 WARNING	<p>Always give right of way to manned aircraft.</p>

 WARNING	Before flying you should seek out flight training from a qualified instructor. Leptron recommends receiving flight training from a Leptron factory trained instructor.
 WARNING	Maintain 500 foot clearance from all persons and property when conducting a post-maintenance functional test flight
 WARNING	Beware of spinning motors and propellers
 WARNING	All parts must be kept out of the reach of children to avoid choke hazard; if a child accidentally swallows any part you should immediately seek medical assistance.
 WARNING	Motors can be very hot after flight!
 WARNING	Do not alter auto pilot firmware or settings. Flight stability can be negatively affected

2. RDASS SYSTEM DESCRIPTION



2.1 List of Components

Table 1: RDASS Basic Components

Item	Qty	Description	Part Number
A	1	Pelican Case with Foam	57605018
B	1	HiTec Charger	57605021
C	2	Flight Battery	57605014
D	C	Anti-Crush Tubes	27606044

Item	Qty	Description		Part Number
E.1	1	HDMI Ribbon Cable		17606427
E.2	HD-2 SD-1	Video Antenna		17606701
F	1	Radio Controller with Charger		17606135
G	1	Video Monitor		57605017
H	1	Tripod, Video Monitor		17606401

Table 2: RDASS Maintenance Kit (Part # 57605029)

Item	Qty	Description	Part Number
-	1	Laminated Checklist 	27670006
I.1	1	Wattmeter 	17606022
-	1	Dynamite Driver toolkit 	17606091
-	1	10mm Open/Closed End Wrench 	17606176
J.1	1	Spare Battery, DX9 Radio 	27606155
K.1	2	Spare e-Props (Right) 	17606024
K.2	2	Spare e-Props (Left) 	17606025
L.1	1	Spare Remote Tether 	57606010

Table 3: Optional Equipment

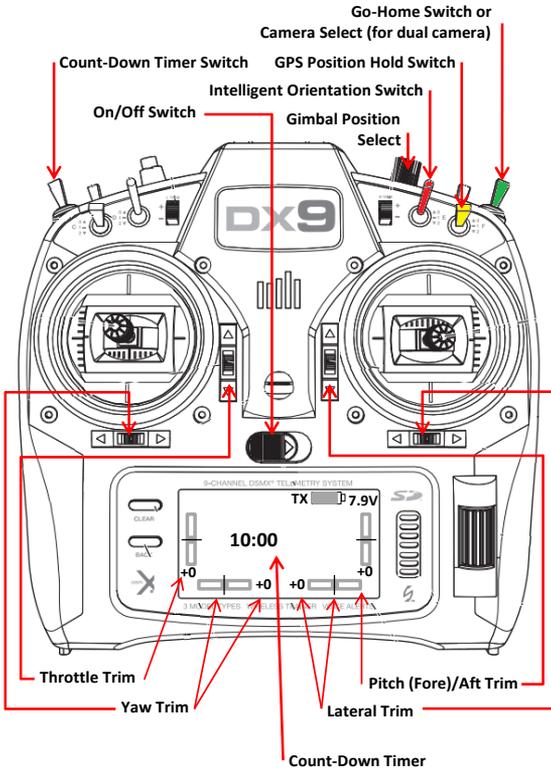
Qty	Description	Part Number
1	Camera 	17606099
1	Camera Gimbal and Power Cable 	87606044
1	Sony α6000 	17606716
1	FLIR Camera 	17606639
1	Gyro Stabilized Dual Camera Gimbal 	17606769
1	RedEdge Multispectral Camera 	17606602
1	PC Ground Control Station 	87600008
1	Tablet/PC 	

Commented [ZM1]: Update Photo

Table 3 (Continued): Optional Equipment

Qty	Description	Part Number
1	GeoReferencer 	17606826
1	Additional Video HDMI Out and Ethernet Out 	87606018
1	SanDisk 64 GB Card 	17606527
1	12 Volt Power Supply 	77610000
1	Red and Blue Strobe 	17606629
1	Red, Green, White Navigation Lights 	57606006

2.2 DX9 Radio Controller Switchology



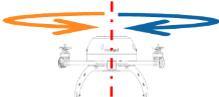
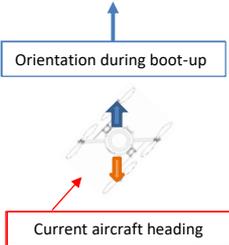
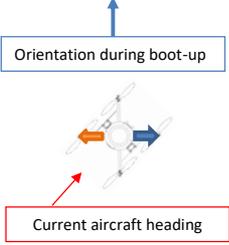


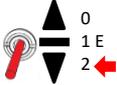
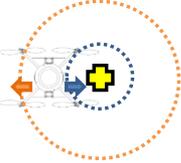
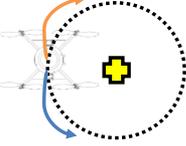
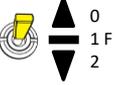
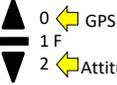
Aircraft Orientation Mode

<p>Throttle</p>	<p>↑ Climb ↓ Descend</p>	
<p>Yaw Control</p>	<p>← Yaw Left → Yaw Right</p>	
<p>Pitch Control</p>	<p>↑ Fly Forward ↓ Fly Rearward</p>	
<p>Roll Control</p>	<p>→ Fly Right ← Fly Left</p>	
<p>Motor Startup</p>	<p>↗↘ Combined Stick Command(CSC) to start motors</p>	<p>Note: If the operator holds the CSC ↗↘ for longer than 2 seconds the motors will shut off</p>
<p>Motor Shutdown</p>	<p>↓ Hold 6 seconds to shutoff motors</p>	<p>Warning: Releasing the Throttle ↓ prior to 6 seconds can result in unintentional flight</p>

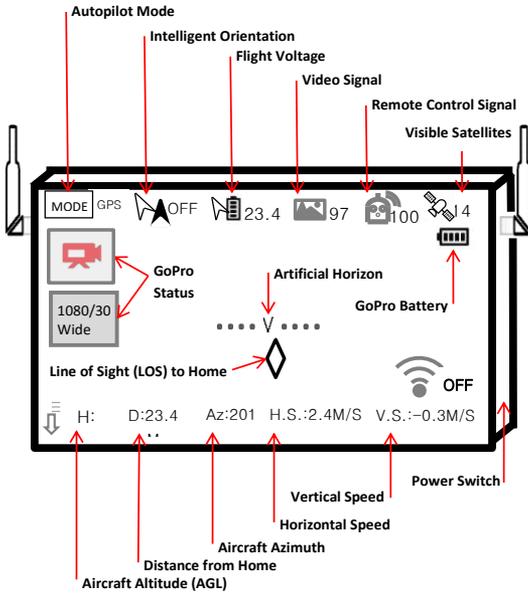


Course Lock Mode

 <p>Throttle</p>	<p>↑ Climb ↓ Descend</p>	
 <p>Yaw Control</p>	<p>← Yaw Left → Yaw Right</p>	
 <p>Pitch Control</p>	<p>↑ Fly in direction that aircraft nose was pointing during boot-up regardless of current aircraft orientation ↓ Fly in direction that aircraft tail was heading during boot-up</p>	 <p>Orientation during boot-up</p> <p>Current aircraft heading</p>
 <p>Roll Control</p>	<p>→ Fly in direction that aircraft right wing was heading during boot-up ← Fly in direction that aircraft left wing was heading during boot-up</p>	 <p>Orientation during boot-up</p> <p>Current aircraft heading</p>

 <p>Point-of-Interest Mode</p>		
 <p>Record Point of Interest</p>	<p>Toggle Switch 3 times between position 0 and position 2 to record Point of Interest</p>	 <p>Purple LED will flash multiple times to indicate a point of interest has been recorded</p>
 <p>Radius Control</p>	<p>↑ Decreases the radius of action ↓ Increases the radius of action</p>	
 <p>Circle Control</p>	<p>↺ Circles point of interest in a counter-clockwise direction as viewed from above ↻ Circles point of interest in a clockwise direction as viewed from above</p>	
 <p>GPS Position Hold</p>	 <p>0 ↖ GPS 1 F 2 ↖ Attitude</p>	<p>Caution: In Attitude Mode the aircraft will drift with the wind</p>
 <p>Go-Home Switch</p>	<p>↑ Normal ↓ Go Home</p>	<p>Regain Control:</p> 

2.3 HD Video Monitor



CAUTION The Pilot-on-the-Controls must exercise caution when directing attention to the Video Monitor. Always use a Visual Observer to aid in obstacle avoidance



3. PC GROUND CONTROL STATION

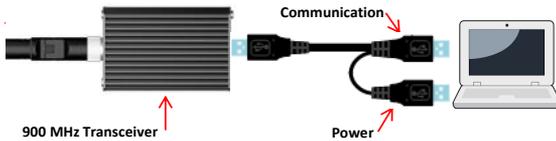
3.1 Ground Control Station Components



3.2 Ground Control Station Procedures

3.2.1 Link Ground Control Station to the Aircraft

1. Attach Antenna to 900 MHz Transceiver Unit.
2. Connect the 900 MHz Transceiver to a computer as shown below. Be sure to connect both the *Communication* and the *Power* interfaces into the computer's USB Ports.
3. In the upper right hand corner of the "GS" app select appropriate *Com Port* from the drop-down menu.
4. Press "CONNECT".



Com Port drop-down menu



3.2.2 Create a Flight Plan Using Photogrammetry Tool

1. Select *Photogrammetry Tool* under Toolbox menu.
2. Configure camera and flight profile information.
3. Select *Click to draw a region which you want to scan* button
4. Position box over area of interest and press Preview.
 - a. Flight Plan will begin at yellow pin and end at red pin
5. Press *Generate* to view flight plan in the *Editor*



3.2.3 Create a Flight Plan Using a Template

1. Select *Route Template* under Toolbox menu.
2. Press *Add Area*, then position box over area of interest.
3. To the right of desired template (e.g. *Circle*), enter altitude under "Alti" column and number of points under "Par" column.
4. Click button of desired template (e.g. *Circle*).
5. Click *Import to Edit List* to view flight plan in the *Editor*.



DJI Ground Station 4.0

Joystick ToolBox Sys_set Language(语言) Help Real Mode

2650.E 40th Ave Den FLY TRACE PATHEXTRUDE MAP DETAILS INSTRUMENT BOARD EDITOR CONTINUE PAUSE COM1 CONNECT

Aircraft NORTH LAT: 022.0000000 EAST LONG: 113.0000000 ALTI: 0000.0 M One Key Takeoff Home Point NORTH LAT: N/A EAST LONG: N/A ALTI: 0000.0 M Set Home Point Go Home

To Home(M):0.0
To Target(M):0.0
Altitude(M):0.0
H.Speed(M/S):0.0
V.Speed(M/S):0.0
MotorVoltage(V):0.0

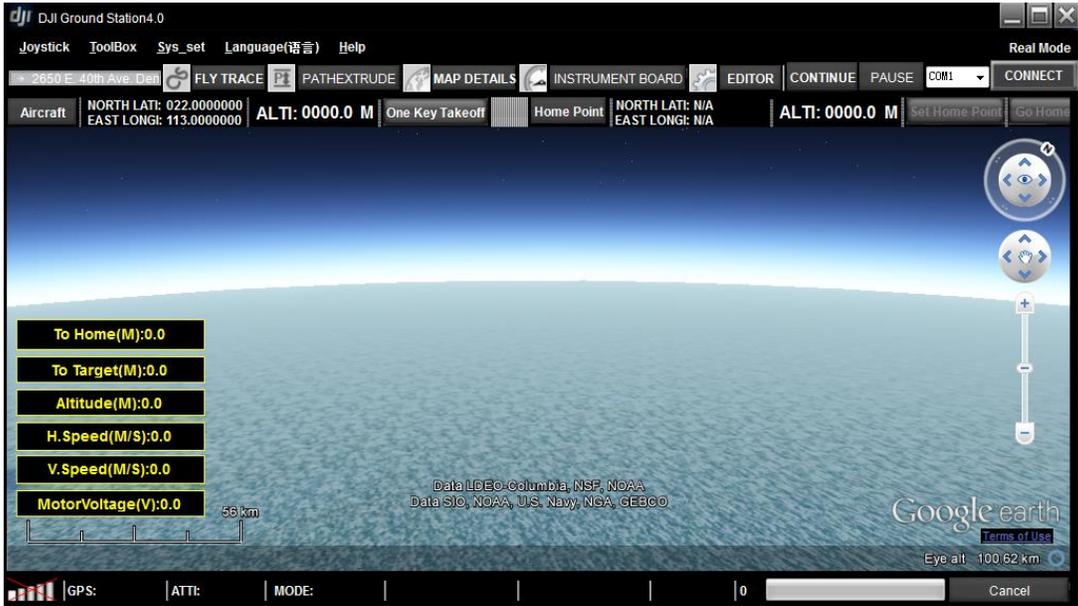
56 km

Data LPDC Columbia, NSF, NOAA
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Google earth

Eye alt 100.62 km

GPS: | ATTI: | MODE: | | 0 | Cancel



3.2.4 Edit, Save, and Recall a Flight Plan



Click to Save

Click to open a saved plan

To edit a property for ALL waypoints

- Click on *Editing Mission* to edit:
 - Mission time limit in seconds
 - Route – Continuous versus Start_to_End
 - Mission Altitude
 - Mission Speed
 - Waypoint Turn Mode

To edit a property for a single waypoint

- Click on a single waypoint to edit:
 - Position – Latitude & Longitude
 - Altitude
 - Waypoint Turn Mode
 - Speed
 - Heading (used for StopAndTurn)
 - Hover Time (used for StopAndTurn)
- To save a flight plan for future use, click the *SAVE* button on the bottom of the *EDITOR*.
- To recall a saved flight plan, click the *OPEN* button on the bottom of the *EDITOR*.

4. BATTERY PROCEDURES

Battery	Type	Charge Setting	Charge Rate (A)	Maximum Voltage (V)	Charge Time
Flight	LiPo	22.2 (6S)	6-8	25.25	~40 min.
Video Monitor	LiPo	11.1 (3S)	6-8	12.65	~30 min.
DX-9	LiPo	7.4(2S)	-	-	~3 hr.

4.1 BATTERY SAFETY

 CAUTION	<p>If a vehicle is to be used for charging, the vehicle must be running for the alternator to continue to charge the car battery. Charging a Flight Battery with a car battery can leave you stranded if you don't run your car.</p>
 CAUTION	<p>The operator should not begin a flight with less than 25.0 Volts on the Flight Battery.</p>
 CAUTION	<p>Do not fly batteries beyond 80% of their capacity (7,200 mAh)</p>
 CAUTION	<p>Do not put the battery into water; store the battery in a cool and dry environment.</p>
 CAUTION	<p>Do not use or store the battery near fire.</p>
 CAUTION	<p>Only use provided charger to charge batteries</p>
 CAUTION	<p>Do not transport or store the battery with metal objects.</p>

 CAUTION	<p>Dropping the battery can cause rupture. Avoid puncturing battery. Do not disassemble or alter the battery.</p>
 CAUTION	<p>Do not use or store the battery in extreme heat environments, such as direct sunlight or in a car. Overheating the battery may affect the performance of the battery and shorten the service life of the battery.</p>
 CAUTION	<p>Battery electrolyte gel can be harmful or fatal if swallowed. Battery electrolyte gel is an eye irritant. If battery ruptures, avoid getting any gel in your eyes. If battery electrolyte gets in eyes, flush eyes with water then seek medical assistance immediately.</p>
 CAUTION	<p>If battery odor, battery swelling, or any other abnormal phenomena occur, discontinue use and discard battery in accordance with local laws.</p>
 CAUTION	<p>Use a clean dry lint-free cloth to clean battery contacts.</p>
 CAUTION	<p>Discarded battery could lead to a fire. Completely discharge the battery and wrap the output terminal with insulating tape before discarding. Discard battery in accordance with local laws.</p>
 CAUTION	<p>Do not charge batteries unattended.</p>
 CAUTION	<p>DO NOT drain the flight battery beyond 80% or leave the battery plugged into the RDASS when unused.</p>
 CAUTION	<p>Land as soon as practicable when the low voltage LED alert flashes to avoid damage to the battery, persons, or property.</p>

4.2 CHARGING THE RADIO CONTROLLER

The DX9 has an internal charger designed to charge the included 2-cell Li-Ion battery at a charge rate of 200mAh. The charge port on the right side of the transmitter is not polarity-dependent. Always charge the transmitter on a heat resistant surface.

1. Power off your transmitter.
2. Connect the power supply connector to the transmitter charge port.
3. Connect the power supply to a power outlet using the appropriate adapter.
4. The blue LED on the front of the transmitter turns on during charging and turns off when the battery is fully charged.
5. Disconnect the transmitter from the power supply once charging is complete and disconnect the power supply from the power outlet.



CAUTION

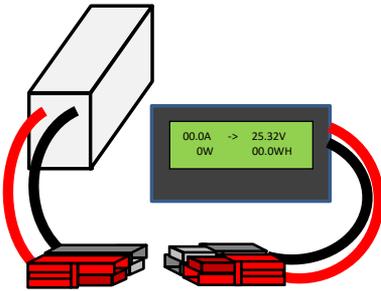
Never connect an external battery charger to your DX9 transmitter. If you wish to charge the Li-Ion battery using a LiPo/ Li-Ion charger, you must remove the battery from the transmitter before charging.

4.3 CHARGING THE GOPRO

Charge the battery by connecting the camera to a computer or other USB charging adapter using the included USB cable. The camera status light turns on during charging and turns off when charging is complete. Use on 5V 1A charger.



4.4 TESTING LIPO BATTERY VOLTAGE



4.5 CHARGING SONY A6000 BATTERY



4.6 CHARGING LIPO FLIGHT BATTERIES

1. Plug in HiTec Charger to 12-18 V Direct Current source;
Select channel 1 or channel 2;
2. Press "INC" to toggle to "LiPo CHARGE". Press "Enter"
3. Press "INC." or "DEC." to toggle Amperage. Press "Enter"
4. Press "INC." or "DEC." to toggle Voltage. Press "Enter"
5. Connect Battery to HiTec Charger
6. Press and hold START for 2 seconds
7. HiTec Charger Prompts "CONFIRM". Press "Enter"

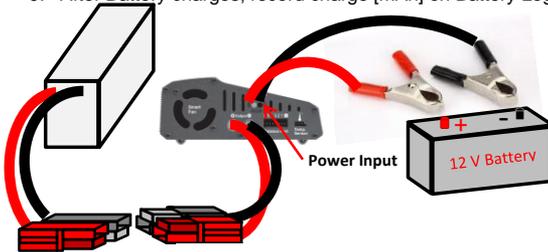
```
R:6SER S:6SER
CONFIRM (ENTER)
```

8. Verify charge [mAh] is counting up

```
LI6s 4.7A 23.19V
CHG 022:43 00682
```

8 mAh Charge

9. After Battery charges, record charge [mAh] on Battery Log



1 Channel Select

2 LiPo CHARGE

3 Amperage

4 Voltage

"INC" to toggle

6 START

7 ENTER



4.7 CHARGING THE VIDEO MONITOR

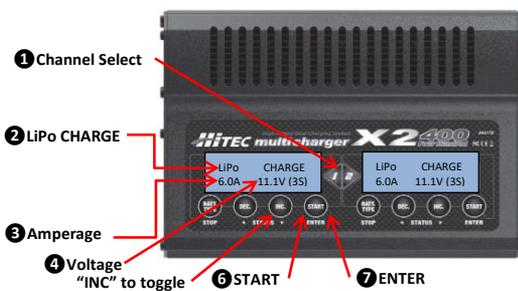
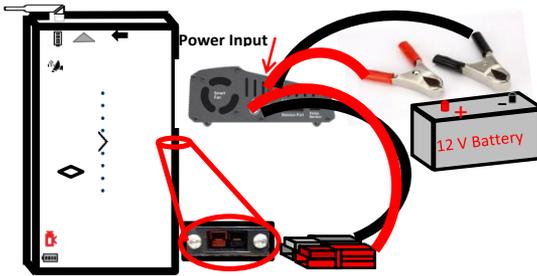
1. Plug in HiTec Charger to 12-18 V Direct Current source;
Select appropriate channel;
2. Press "INC." to toggle to "LiPo CHARGE". Press "Enter"
3. Press "INC." or "DEC." to toggle Amperage. Press "Enter"
4. Press "INC." or "DEC." to toggle Voltage. Press "Enter"
5. Connect Video Monitor to HiTec Charger
6. Press and hold START for 2 seconds
7. HiTec Charger Prompts "CONFIRM". Press "Enter"

```
R:3SER  S:3SER
CONFIRM (ENTER)
```

8. Verify charge [mAh] is counting up

```
LI3s  4.7A  10.16V
CHG   022:43  00682
```

8 mAh Charge



4.8 LIPO BATTERY STORAGE PROCEDURES

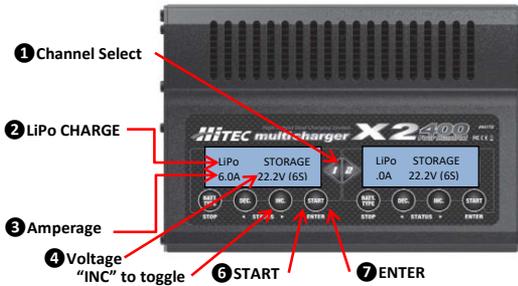
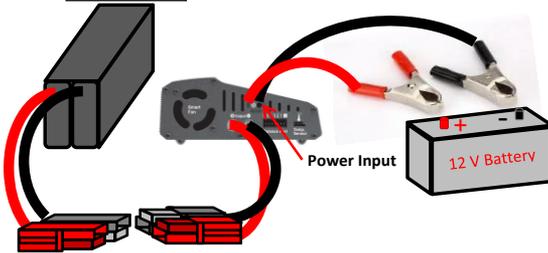
1. Plug in HiTec Charger to 12-18 V Direct Current source;
Select appropriate channel;
2. Press "INC" to toggle to "LiPo STORAGE". Press "Enter"
3. Press "INC." or "DEC." to toggle Amperage. Press "Enter"
4. Press "INC." or "DEC." to toggle Voltage. Press "Enter"
5. Connect Ground Station to HiTec Charger
6. Press and hold START for 2 seconds
7. HiTec Charger Prompts "CONFIRM". Press "Enter"

```
R:6SER S:6SER
CONFIRM (ENTER)
```

8. Verify charge [mAh] is counting up

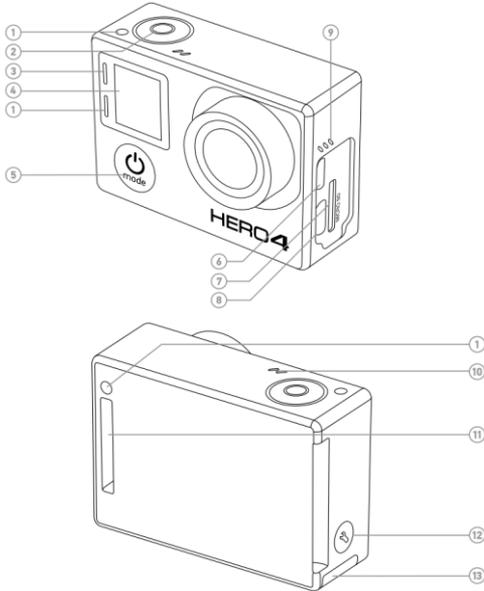
```
LiPo 4.7A 23.19V
STO 022:43 00682
```

8 mAh Charge



5. Cameras

5.1 GoPro Hero4



1. Camera Status Light (red)	6. Micro HDMI Port (cable not included)
2. Shutter/Select Button	7. micro SD Card Slot (micro SD card not included)
3. Wireless Status Light (blue)	8. Mini-USB Port (supports composite A/V cable/3.5mm stereo mic adapter, not included)
4. Camera Status Screen	9. Audio Alert
5. Power/Mode Button	10. Microphone
11. HERO Port	12. Settings/Tag Button
13. Battery Door	

5.1.1 Common GoPro Operations

5.1.2 Take Time Lapse Photos



Take Time Lapse Video



Capture Time Interval Stills While Recording Video



Adjust Video Resolution



Adjust Photo Resolution



5.1.3 GoPro Camera Specifications

Sensor Size	1/2.3-inch type 4:3 sensors with 4,000 x 3,000 pixels
-------------	---

Field-of-View		
	Vertical	Horizontal
4 x 3 Wide	94.4°	122.6°
4 x 3 Medium	72.2°	94.4°
4 x 3 Narrow	49.1°	64.6°
17 x 9 Wide	69.5°	125.3°
16 x 9 Wide	69.5°	118.2°
16 x 9 Medium	55°	94.4°
16 x 9 Narrow	37.2°	64.4°

5.1.4 GoPro Hero4 Menus

GOPRO MODES



 Power



 Power



 Power

 SET UP

VIDEO MODES

 Video

 Video + Photo

 Looping

VIDEO SETTINGS

 Interval

FPS Frames Per Second

 Auto Low Light

 Video Resolution

FOV Field of View

 Spot Meter

 Protune

PHOTO MODES

 Single Photo

 Continuous Photos

 Night Photo

PHOTO SETTINGS

S Shutter

MP Megapixels

 Interval

 Spot Meter

 Protune

PROTUNE SUB-MENU

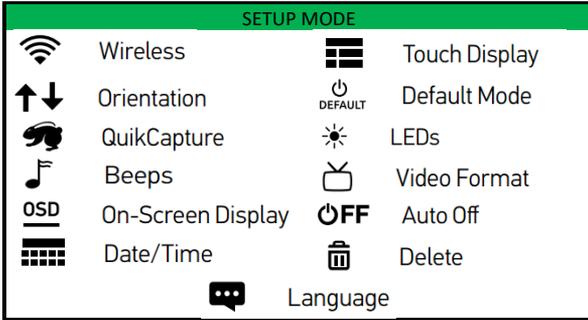
 White Balance

 ISO Limit

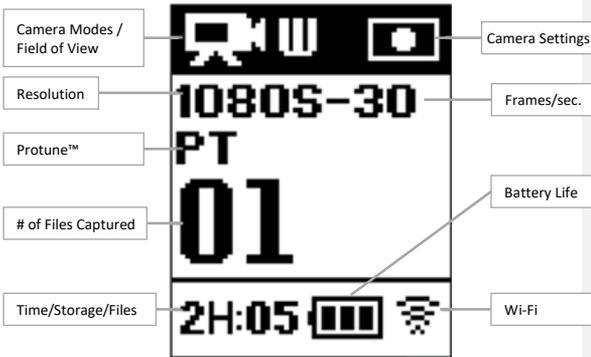
 Color

 Sharpness

 Exposure Value Compensation



5.1.5 GoPro Status Screen



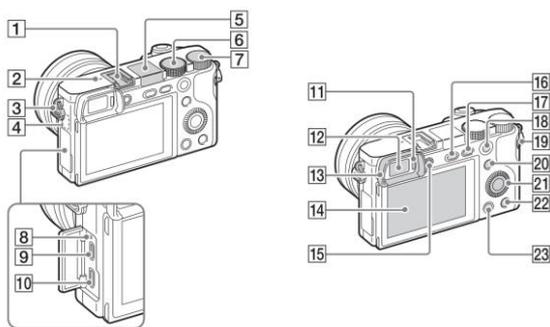
5.2 FLIR Vue and FLIR Vue Pro

5.2.1 FLIR Vue and FLIR Vue Pro Specifications

- Polarity Control (Black Hot/White Hot) and Color Palettes can be adjusted using the Camera Controller GUI application on a computer. For FLIR Vue Pro a mobile app is available.
- Do not touch the lens. If the lens gets dirty, a light dusting of air should dislodge any dust particles. If the lens is still noticeably dirty, use 75% isopropyl alcohol and lens tissue. Use a light wiping motions with a fresh section of lens tissue with each swipe so as not to drag dust or dirt particles back over the lens surface.
- FLIR Vue is neither water nor dust resistant. Care for it as you would any valuable piece of electronics equipment.

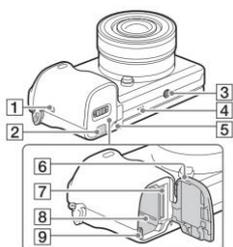
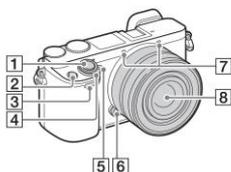
Thermal Imager	Uncooled VOx Microbolometer
Resolution	640 x 512
Lens Option	9 mm; 69° x 56° 13 mm; 45° x 37° 19 mm; 32° x 26°
Spectral Band	7.5 μm – 13.5 μm
Full Frame Rates	30 Hz (NTSC); 25 Hz (PAL) US only, not for Export
Exportable Frame Rates	7.5 Hz (NTSC); 8.3 Hz (PAL)
Size	2.26" x 1.75" (57.4 mm x 44.5 mm) (including lens)
Weight	3.25 oz. to 4.0 oz. (92.1 g to 113.4 g) configuration dependent
Input Supply voltage	4.0 VDC – 6.0 VDC
Power Dissipation, steady state (max 2.5 W during shutter event of approximately 0.5 seconds)	<1.2 W
Operating Temperature Range	-20°C to 50°C
Non-Operating Temperature Range	-55°C to 95°C
Operational Altitude	40,000 feet

5.3 Sony α6000



Rear View

1	Multi interface shoe	13	Eyepiece cup
2	Image sensor position mark	14	LCD screen
3	Hook for shoulder strap	15	Diopter-adjustment dial
4	Wi-Fi sensor (built-in)	16	(Flash pop-up) button
5	Flash	17	MENU button
6	Mode dial	18	AEL button / Playback zoom
7	Control dial	19	MOVIE (Movie) button
8	Charge lamp	20	Fn (Function) button / Send to Smartphone
9	Multi/Micro USB Terminal	21	Control wheel
10	HDMI micro jack	22	C2 (Custom 2) button/ (Delete) button
11	Eye sensor	23	(Playback) button
12	Viewfinder		



Front View	
1	Shutter button
2	C1 (Custom 1) button
3	Remote sensor
4	ON/OFF (Power) switch
5	Self-timer lamp/AF illuminator
6	Lens release button
7	Microphone
8	Lens

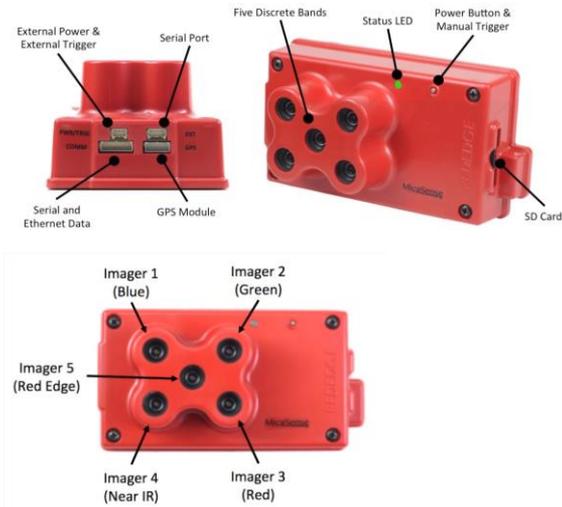
Bottom View	
1	NFC function
2	Connection plate cover
3	Tripod socket hole
4	Speaker
5	Access lamp
6	Battery/memory card cover
7	Memory card slot
8	Battery insertion slot
9	Battery eject lever

5.3.1 Sony α6000 Camera Specifications

Sensor	Image sensor: APS-C format (23.5 mm x 15.6 mm) CMOS image sensor Total pixel number of image sensor: Approx. 24,700,000 pixels Effective pixel number of camera: Approx. 24,300,000 pixels	
Field-of-View For 20mm lens	Vertical	Horizontal
	40.8°	58.5°

5.4 MicaSense RedEdge

5.4.1 MicaSense RedEdge Camera Specifications



Sensors	4.8 mm x 3.6 mm , 1280 x 960 Global Shutter Focal length: 5.5 mm Aspect Ratio: 4:3	
Band 1	Blue Filter	
Band 2	Green Filter	
Band 3	Red Filter	
Band 4	Near IR Filter	
Band 5	Red Edge	
Field-of-View	Vertical	Horizontal
	36.2°	47.1°

5.5 Additional Ethernet Out



1. Install the antennas on the Lightbridge
2. Connect the HDMI Out on the Lightbridge to the HDMI in on the Matrox.
3. Plug Matrox, Lightbridge, and up-scaler (if in use) into power.
4. Tap then hold the power button on the Lightbridge to turn on (same sequence of tap then hold will turn Lightbridge off).
5. Connect Ethernet out on Matrox to Ethernet port on computer.
6. Place SD card in matrox if recording is desired
7. Go to User Interface to complete setup.

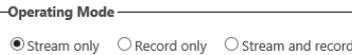
Use explorer to navigate to



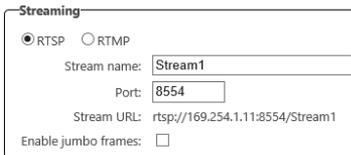
Go to Settings >>
Stream
Username: admin
Password: admin



Select *Stream only*
or *Stream and*



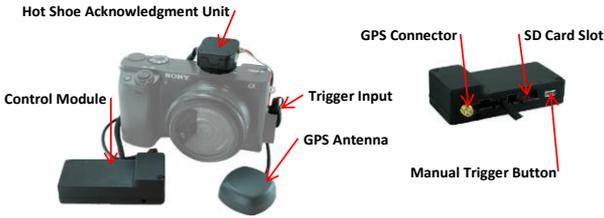
Select *Steaming*



6. GeoReferencer

The GeoReferencer offers precision photo triggering while recording every capture event's location, altitude, and direction information.

6.1 GeoReferencer Components



6.2 Configuring the GeoReferencer

- To configure the GeoReferencer open the Config.txt file and follow the instructions.
- If the Config.txt file is lost, install the SD card in the GeoReferencer and power the module and a new Config.txt file will be created.

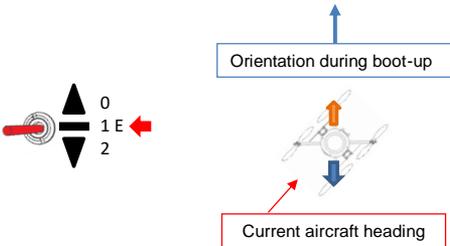
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7. FLIGHT PROCEDURES

7.1 Course Lock Procedure

- The aircraft's autopilot records the aircraft's heading during boot-up. This initial aircraft orientation can be used to steer the aircraft during flight.
- After connecting the flight battery, the autopilot does a self-initialization. The LED Autopilot Status Light will blink with a quick sequence of green LED flashes to indicate that the home-point and the aircraft's orientation have been recorded.

- Engage Course lock by moving the Intelligent Orientation Switch to position "1". Direction control inputs will now be relative to the aircraft's orientation at boot-up regardless of current aircraft heading.



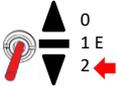
- To dis-engage Course Lock simply return the Intelligent Orientation Switch to position "0". Direction inputs will be relative to the nose of the aircraft.



7.2 Point of Interest Procedure

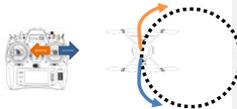
- To record a point of interest (POI) quickly toggle the switch labeled "E" 3 times from position "0" to position "2".



- Leave the switch in position "2". 
- The LED Autopilot Status Light will blink with a quick sequence of purple LED flashes to indicate that the point of interest has been recorded. 
- If the operator wishes to orbit the point of interest, apply an aft directional control input to establish the radius of action up to 500 meters.



- Next, apply a left or right directional control input to orbit the POI. The aircraft will adjust the aircraft heading to maintain a nose-in orientation on the POI.



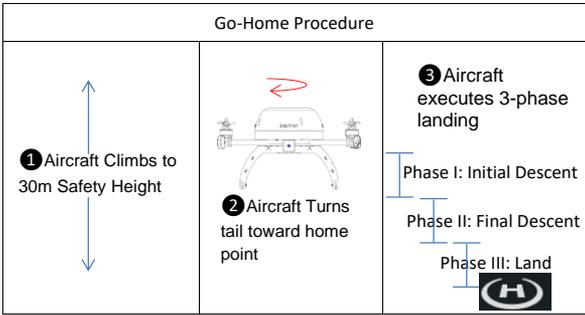
- Once the POI has been recorded the operator may re-engage the Point-of-Interest Mode at any time during the flight and the aircraft will orient the nose of the aircraft toward the POI.
- The operator retains altitude control with the throttle while in the Point-of-Interest Mode.

7.3 Go-Home Procedure



- For Dual Camera equipped aircraft, switch “F” (green switch) is used for video switching – the Go-Home feature is disabled.
- To execute a Go-Home the Pilot-on-the-Controls shall toggle the Go-Home switch to the full aft position and immediately return the switch to the full forward position.
- To execute a Go-Home using the Ground Station press the Go-Home Button.

Go Home

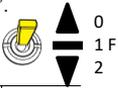


 NOTE	Autopilot commands Go-Home after 3 seconds of lost communication with the Radio Controller.
 CAUTION	Phase III is not recommended. The pilot should regain control of the aircraft and land with the Radio Controller.
 CAUTION	Turning the Radio Controller off prior to the disconnecting the RDASS Flight Battery may result in uncommanded flight. The Autopilot will execute a Go-Home 2 seconds after Radio Controller power off.
 NOTE	Always follow Flight Checklist.

7.4 Remote Control Take Back Procedure



To regain control of the aircraft after executing a Go-Home command, toggle the GPS Position Hold switch (labeled “F”) from position “0” to position “2” and immediately return the switch to position “0”.



 <p>NOTE</p>	<p>The take back procedure is also used to regain control of the aircraft while flying with the Ground Station.</p>
 <p>CAUTION</p>	<p>The Pilot-on-the-Controls will not be able to regain control of the aircraft if the Go-Home (green) switch is left in the aft position. Verify that the Go-Home (green) switch is forward before attempting to regain control of the aircraft with the GPS Position Hold (yellow) switch.</p>

7.5 Camera Selection

- To change the active camera while flying the IR/Standard Definition Camera configuration, toggle the green switch full aft and then immediately return the switch to the forward position.

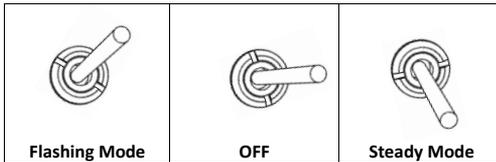


7.6 Gyro-Stabilized Gimbal Initialization

- Place the aircraft on a level, non-metallic surface prior to connecting the battery.
- After connecting the aircraft battery, the gimbal will receive power from the aircraft. Do not move the aircraft until the gimbal has finished initializing.
- After approximately 30 seconds the gimbal will emit 4 tones to indicate it is ready for flight.

7.7 Operating the Navigation Lights

- The navigation lights are controlled by a three-position switch located on the landing gear.



8. HD FLIGHT CHECKLIST

PRE-FLIGHT CHECKS	
<input type="checkbox"/>	1 Conduct Crew Brief
<input type="checkbox"/>	2 Install SD Card(s) (GeoReferencer, Camera)
<input type="checkbox"/>	3 Video Monitor Checks
<input type="checkbox"/>	Video Monitor Battery - Check (11.0 Volts minimum)
<input type="checkbox"/>	Tripod - Attach Video Monitor
<input type="checkbox"/>	Video Monitor Antenna - Attach
<input type="checkbox"/>	Video Monitor Power and Lightbridge Power – On
<input type="checkbox"/>	4 Radio Controller Checks
<input type="checkbox"/>	Radio Controller Switches - Down and Away
<input type="checkbox"/>	Radio Controller Power Switch–Verify Off Power ON will Disable RC
<input type="checkbox"/>	Radio Controller Tether - Attach
<input type="checkbox"/>	Radio Controller Voltage – Check 10.5 (7.5 DX9) Volts minimum
<input type="checkbox"/>	Radio Controller Trim Settings - Zero (4 Trims)
<input type="checkbox"/>	5 Flight Battery Installation
<input type="checkbox"/>	Flight Battery - Check and Record Voltage (25.0 Volts minimum)
<input type="checkbox"/>	Flight Battery – Install with Velcro Strap Do Not Trap Ribbon Cable
<input type="checkbox"/>	DO NOT CONNECT BATTERY AT THIS TIME
<input type="checkbox"/>	Gimbal – Check Freedom of Movement
<input type="checkbox"/>	6 Mechanical Checks – Bottom
<input type="checkbox"/>	Landing Gear – Check
<input type="checkbox"/>	Camera Mounting Bracket and Gimbal Mounts – Check
<input type="checkbox"/>	Video and Gimbal Ribbon Cables - Check
<input type="checkbox"/>	Camera(s) – Check (remove lens cover)
<input type="checkbox"/>	Underside - Check for Worn/Loose Items
<input type="checkbox"/>	7 Mechanical Checks – Top
<input type="checkbox"/>	Aircraft Antennas – Attach and verify pointing down (away from rotor)
<input type="checkbox"/>	Main Rotor Nuts - Check Tightness (Hold motor housing)
<input type="checkbox"/>	Motor Mounts and Arms - Check Security and Verify Level/Plumb
<input type="checkbox"/>	Rotor Blades – Check Condition

GROUND STATION SETUP (if in use)	
<input type="checkbox"/>	Ground Station Antenna on Aircraft – Install
<input type="checkbox"/>	Laptop Battery - Check (50% minimum)
<input type="checkbox"/>	[Optional] Laptop WiFi – Connect to Cell Phone Hot Spot
<input type="checkbox"/>	Ground Station Antenna (Ground Unit) - Install
<input type="checkbox"/>	Ground Station USB – Connect 2 into laptop
<input type="checkbox"/>	Ground Station App – Launch
<input type="checkbox"/>	Flight Plan - Build or Open as required

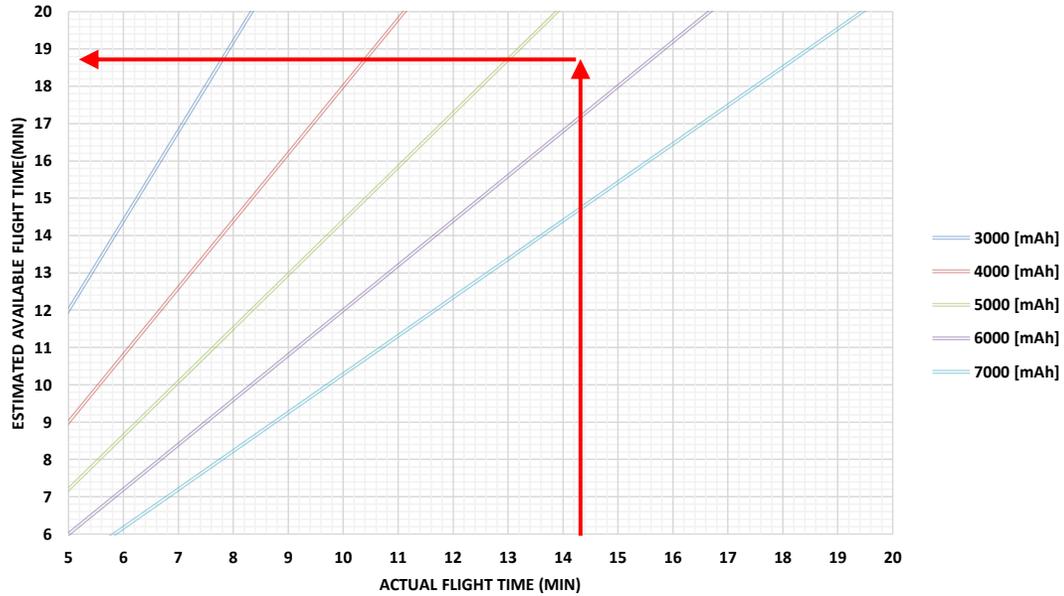
FLIGHT PREPARATION	
<input type="checkbox"/>	Place aircraft on Level Non-Metallic Surface
<input type="checkbox"/>	LED (Tail) Toward Operator
<input type="checkbox"/>	Camera(s) Power – ON (Lens cap removed)
<input type="checkbox"/>	Camera Settings – Set as required (Reset Image Count)
<input type="checkbox"/>	Flight Battery – Connect (outside of skids)
<input type="checkbox"/>	Allow up to 40 seconds for Gimbal to initialize – indicated by 4 tones
<input type="checkbox"/>	Compass Calibration – Complete 1 st flight of day then Power Cycle
<input type="checkbox"/>	Green LED Sequence – Verify
GeoReferencer Preparation (if in use)	
<input type="checkbox"/>	Camera Trigger – Depress to activate camera
<input type="checkbox"/>	GeoReferencer Battery – Connect
<input type="checkbox"/>	GeoReferencer Triggering – Verify
GROUND STATION PREPARATION (if in use)	
<input type="checkbox"/>	Connect Ground Station to aircraft
<input type="checkbox"/>	Relative Height Procedure – Execute
TAKE-OFF CHECKS	
<input type="checkbox"/>	Verify SD Card(s) Installation
<input type="checkbox"/>	Aircraft/Payload Status – Verify(Camera Rec, Sats., Volts, Height)
<input type="checkbox"/>	Check area for non-participants and potential hazards
<input type="checkbox"/>	Timer – Activate
<input type="checkbox"/>	Motors - Startup (Keep Throttle at ¼ position)
<input type="checkbox"/>	Takeoff – Verify Aircraft Stability
<input type="checkbox"/>	Ground Station "GO" Button – Press as required (if in use)
POST FLIGHT CHECKS	
<input type="checkbox"/>	Throttle Stick - Full Down for 6 seconds Verify Rotors STOP
<input type="checkbox"/>	Timer - Stop (Announce Flight Time to VO for Logbook)
<input type="checkbox"/>	Flight Battery – Disconnect
<input type="checkbox"/>	Camera Power – OFF (Stop recording then power off)
<input type="checkbox"/>	Camera Lens Cover – Replace
<input type="checkbox"/>	Motors – Check for excessive heat (Warning: motors can be Hot!)
<input type="checkbox"/>	Radio Controller Tether– Disconnect
<input type="checkbox"/>	Video Monitor Power and Lightbridge Power – OFF
<input type="checkbox"/>	SD Card – Review Recording
<input type="checkbox"/>	Antennas – Remove (Video Monitor, RDASS, Ground Station)
<input type="checkbox"/>	IR Camera (if installed) – Point down before storing in case
<input type="checkbox"/>	Flight Logs – Record
<input type="checkbox"/>	NOTAMS – Close as required
<input type="checkbox"/>	Post Flight Debrief– Complete

8.1 Crew Brief

CREW BRIEF	
1	Aircraft
	Time Available on Flight Battery with five minute reserve
	Time Available on SD Data Recorder
2	Scheme of Maneuver
	Timeline of Events & Radio Controller Timer Settings
	Route of Flight, Altitudes, Airspeeds
3	Airspace
	Required Radio Calls
	Satellite Coverage (Number Visible)
	http://www.trimble.com/gnssplanningonline/
	Weather (Winds, Visibility, Ceiling)
	Obstacles and Hazards
4	Crew Duties
	Designate a Pilot in Command
	Pilot on the controls:
	1) Fly aircraft (focus on Vehicle)
	2) Traffic/obstacles avoidance
	3) Monitor FLIGHT CLOCK
	Pilot not on the controls:
	1) Assist avoiding traffic/obstacles
	2) Cross check FLIGHT CLOCK
	3) Assist in Maintaining Aircraft Position and Orientation
	4) Operate Ground Station as required
	5) Monitor and transmit on assigned radios
	6) Perform other duties as assigned by the Pilot on the controls
5	Transfer of Aircraft Control
	3-Way Positive Transfer of the Controls
6	Crew Coordination
	Two challenge rule
	Most Conservative Approach
	Avoid Excessive Professional Courtesy
7	Post Flight Responsibilities
	Disconnecting the Flight Battery
	Battery Charging Procedures
	Logbook
8	Back Brief

8.2 LED Autopilot Status Lights

LED Code	Meaning
System Startup	
	System Startup and Self-Check
	Forward direction for IOC recorded successfully
	Less than 5 Satellites in view (GPS Mode)
	Less than 5 Satellites in view (IOC Mode)
	5 Satellites in view (GPS Mode)
	5 Satellites in view (IOC Mode)
	Greater than 5 Satellites in view (GPS Mode)
	Greater than 5 Satellites in view (IOC Mode)
	GPS Position Hold Mode
	Attitude Control Mode
	Intelligent Orientation Mode (Course Lock or Point-of-Interest)
	Record Point of interest
	Waypoint Mode on the Ground Station
	Poor attitude status (GPS Mode)
	Poor attitude status (IOC Mode)
	Bad attitude status (GPS Mode)
	Bad attitude status (IOC Mode)
	Go-Home has been commanded
	Lost Link between aircraft and remote
Compass Calibration	
	Begin horizontal calibration
	Begin vertical calibration
	Calibration Failure
	Abnormal compass data
Low Voltage Warnings	
	Impending low battery voltage (triggers at 21.8 Volts)
	Critically low battery voltage (triggers at 21.2 Volts) - Land without delay



9. PERFORMANCE AND LIMITS

9.1 Aircraft Specifications

Platform Type	Multi-Rotor (four fixed-pitch rotors)
Rotor tip to rotor tip dimensions	31 ½ inches (80.1 cm)
Operating Temperature	14°F ~ 122°F (-10°C ~ 50°C)
Take-off Weight	7 lbs. 13 ounces (3539g)
Weight without Battery	5 lbs. (2269g)
Hovering Accuracy (GPS Mode)	Vertical: ± 31in (0.8m) Horizontal: ± 98 in (2.5m)
Max Yaw Angular Velocity	180°/s
Max Tilt Angle	35°
Max Horizontal Flight Velocity	35 mph (30 knots, 15 m/s)
Wind Limits	35 mph (30 knots, 15 m/s) or gusts of 25 mph (22 knots, 11 m/s)
Vertical Speed Limits	800 feet/min. (4.1 m/s)
Supported Flight Battery	LiPo 6S
Operational Ceiling	12,000 Feet DA (3650 m)
Maximum payload	1 lb. 8 ounces (680g)
Operational Range	1.5 mi. (2.4 km)
Max. Power Consumption	800 Watts (1.1 hp)

Commented [ZM2]: Verify this 300 W vs. 800 W

9.2 Flight Time Calculation

Example: RDASS flew 14 minutes and 19 seconds. Flight Battery required 5459[mAh] to fully charge. How much available flight time is there? (Under similar flight conditions this battery can be flown 18 minutes and 53 seconds)

- 1) Convert minutes and seconds to decimal minutes

$$\left(\frac{19 [\text{sec.}]}{60 [\text{sec.}]} + 14 [\text{min.}] \right) = 14.31 \text{ minutes}$$

- 2) Multiply the decimal minutes by 80% of battery capacity

$$14.31 [\text{min.}] \times 7200 [\text{mAh}] = 103,080 [\text{min} \cdot \text{mAh}]$$

- 3) Divide the result from step 2 by the required charge

$$\frac{103,080 [\text{min} \cdot \text{mAh}]}{5459 [\text{mAh}]} = 18.88 [\text{min.}]$$

- 4) Multiply by 60 to convert decimal minutes to seconds

$$18.88 [\text{min.}] = (0.88 \times 60) + 18 = 18:53$$

10. USER-LEVEL MAINTENANCE

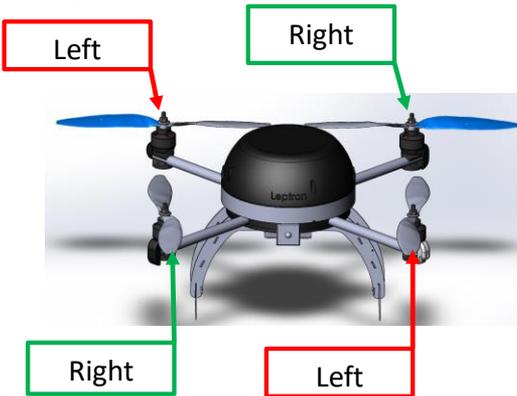
10.1 Rotor Removal

1. Use a 10 mm wrench to remove the nut by turning counter-clockwise
2. Remove and save the anodized black washer for use with new rotor blade
3. Remove the rotor blade from the motor post
4. Remove and save the aluminum bushing from the motor post. (If the bushing remained inside the rotor blade, remove the bushing from the rotor blade)

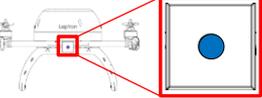
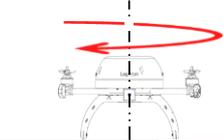
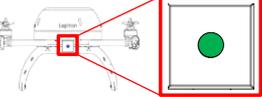
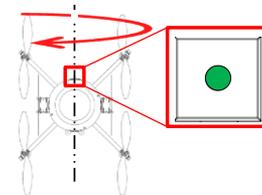
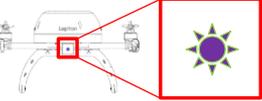


10.2 Rotor Installation

1. Place the aluminum bushing on the motor post
2. Install the correct rotor blade
3. Install the anodized washer
4. Install the 10mm nut by turning clockwise until increased resistance is felt
5. Use a 10mm wrench to turn the nut an additional quarter turn



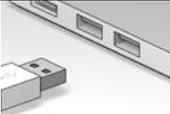
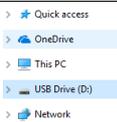
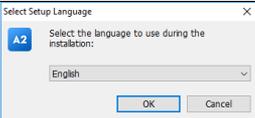
10.3 Compass Calibration

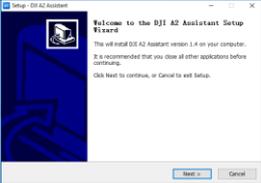
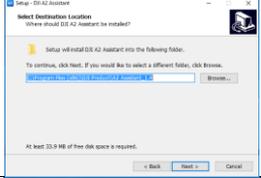
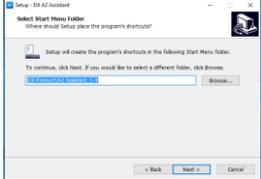
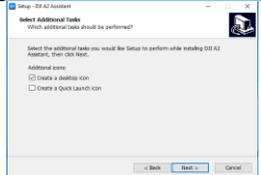
1	Quickly flip the GPS Position Hold (yellow) Switch 6-10 times	
2	A solid blue LED will indicate the aircraft is ready to begin the horizontal calibration	
3	Slowly rotate the aircraft 360° about its vertical axis (aircraft in a level attitude). Do not exceed 90° in three (3) seconds.	
4	A solid green LED indicates the aircraft is ready to begin the vertical calibration	
5	Tilt the aircraft so that the LED Indicator is up (Nose Downward). Slowly rotate the aircraft about its longitudinal axis. Do not exceed 90° in three (3) seconds.	
6	The Purple Heartbeat LED indicates the compass calibration was successful. Blinking red LED indicates the calibration must be repeated.	
7	Disconnect then reconnect Flight Battery	

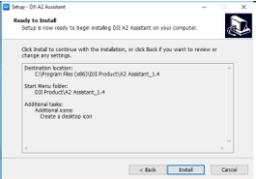
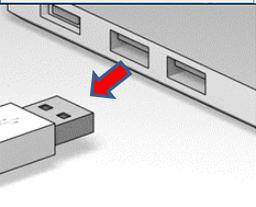
10.4 IMU Calibration

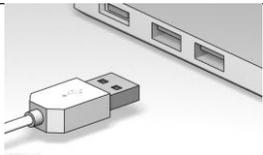
The IMU (Inertial Measurement Unit) includes a 3-axis accelerometer, a 3-axis angular velocity and a barometric altimeter. It is used to recognize and maintain aircraft attitude. The IMU calibration will fix many of the RDASS HD issues including erratic flying errors.

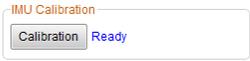
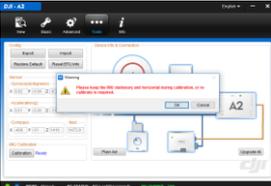
 <p>WARNING</p>	<p>Leptron requires the IMU to be calibrated upon receiving the aircraft and any time erratic flight behavior is observed, or in the event of a crash.</p>
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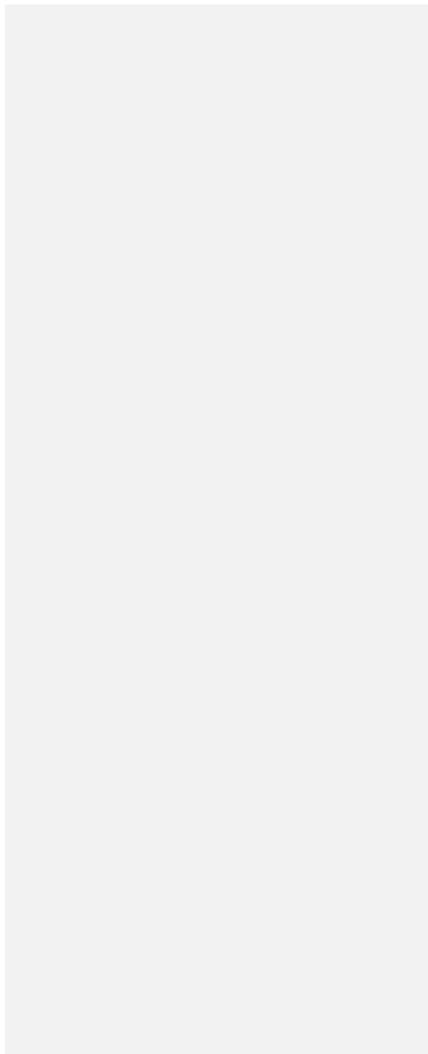
Steps highlighted in red are only necessary to complete one time (the 1st time) for installation of the Assistant software.	
<p>1</p> <p>Plug in USB thumb drive</p>	
<p>2</p> <p>Open the thumb drive folder</p>	
<p>3</p> <p>Double click on "DJI A2 Assistant_1.4"</p>	
<p>4</p> <p>Select install language and press "OK"</p>	

5	Click "Next" on the Welcome window	
6	Check the box at the bottom of the License Terms window to accept the terms.	
7	Click "Install"	
8	Click "Next" on the Setup window	
9	Click "Next" on the 'Select Destination Location' window	
10	Click "Next" on the 'Select Start Menu Folder' window	
11	Click "Next" on the 'Select Additional Tasks' window	

<p>12</p> <p>Click "Install" on the 'Ready to Install' window</p>	
<p>13</p> <p>Click "Finish" on the 'Complete Setup' window</p>	
<p>14</p> <p>Eject and disconnect the USB thumb drive</p>	
<p>15</p> <p>Loosen the four prop nuts (one for each motor) that secure the propeller to the motor shafts</p>	
<p>16</p> <p>Setup the aircraft according to the preflight checklist</p>	
<p>17</p> <p>Plug in the microUSB side of the connector cable into the port located on the aircraft LED</p>	

<p>18 Plug in the USB side of the connector cable into the USB port on the A2 assistant computer</p>	
<p>19 Power on the aircraft</p>	
<p>20 Launch DJI A2 Assistant</p>	
<p>21 Click "Cancel" on the 'User Login' window</p>	
<p>22 Click the "Tools" tab at the top of the A2 Assistant main screen</p>	

<p>23 Position the bubble level on the center of the aircraft dome and center the bubble in the level by adjusting the landing gear with shims. Ensure the aircraft is located on a steady surface and do not touch the aircraft during the IMU calibration</p>	
<p>24 In the "Tools" tab, click the "Calibration" button</p>	
<p>25 Read the 'Warning' window and click "OK"</p>	
<p>26 'Info' window will show "IMU Calibrate Success" when IMU is calibrated successfully.</p>	
<p>27 Close the A2 Assistant</p>	
<p>28 Disconnect the aircraft power</p>	
<p>29 Disconnect the pc to aircraft connecting cable</p>	



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