



FLIGHT MANUAL FOR KAUSALYA DRONE

Kushal innovation and incubation foundation

(Version-3)

14-12-2023



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Version Control:

Date	Version	Amendments	Page Number	Reviewed by	Approved by
13-06-2023	1	N/A	N/A	Saikumar Pallati	Sai Raj Bayela
04-10-2023	2	N/A	N/A	Saikumar Pallati	Sai Raj Bayela
14-12-2023	3	1.Life of critical items 2. Battery charging SOP			

Reference

Following terms have been used in the subsequent chapters

#	Term	Full Form/Abbreviation
1	GCS	Ground Control Station
2	QGC	QGroundControl
3	UAS	Unmanned Aircraft System
4	UIN	Unique Identification Number
5	RTL	Return to Land

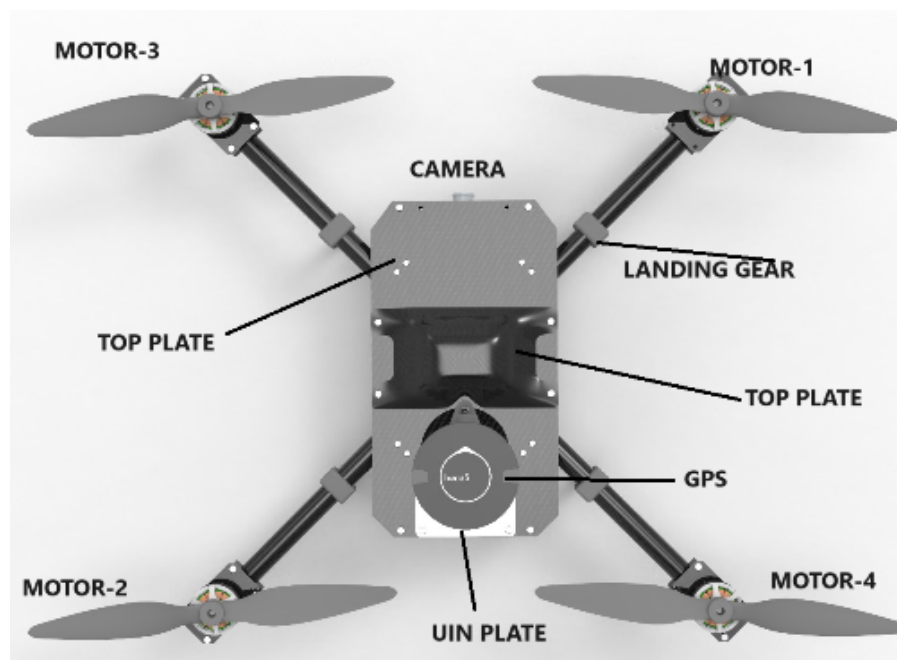
Chapter 0: Unboxing

0.1 List of items:

These are the items inside the package:

1. Drone UAV
2. Radio controllers -2 (1- Master & 1-Slave)
3. Battery pack
4. Tool box
5. Battery charger
6. Warranty & Insurance
7. Flight manual
8. Maintenance manual
9. LOG book (Battery log book, Maintenance log book & Flight Log book)
10. Flight checklist

0.2 Schematic diagram:

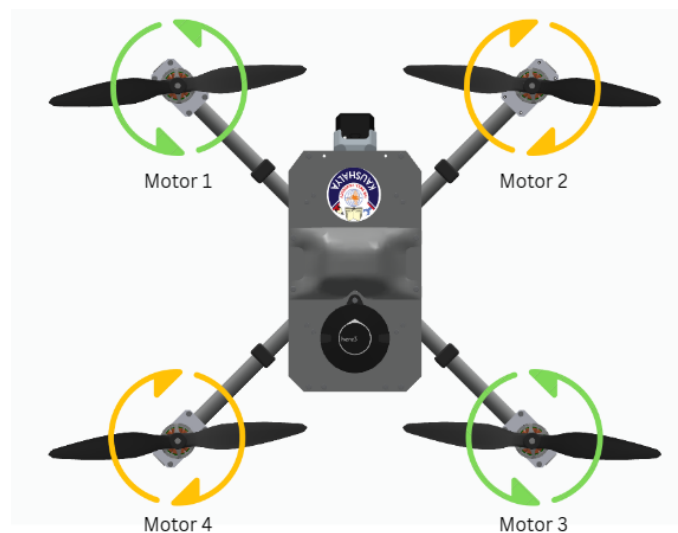


Nos.	Name	Function
1	Propeller	generates the airflow necessary for flight and maneuvering
2	Motor	generate required thrust to propel the drone for flight.
3	Carbon fiber plates	Form the structural framework of the drone
4	Battery slot	The location for battery assembly on drone
5	GPS	Provides position coordinates essential for navigation

6	Motor mounts	Ensures the motors are securely held in place
7	Arms	Structural elements linking motor mounts to the frame
8	Landing gear	ensures secure landing on drone landing pads
9	Radio Controllers	Transmits signals to the radio controllers which enables pilot to operate from a distance

0.3 Installation:

After unboxing the UAS, only propellers need to be installed. The installation steps are mentioned below



1. Motor 1 and 3: The **anticlockwise propeller** has to be assembled and the direction is indicated on the diagram, marked in green.
2. Motor 2 and 4: The **clockwise propeller** has to be assembled and the direction is indicated on the diagram, marked in green.

0.4 Flight checklist:

0.4.1 Preflight checklist:

Preflight checklist			
#	Items	Pass criteria	Yes/ No
1	Arm connector bolts tight	Tight	
2	Compass direction	Towards North	
3	Minimum voltage	Should not be less than 15.6 Volts	
4	Propeller bolts	Tight	

5	Landing gear bolts	Tight	
6	Battery knob	Tight	
7	Arm mounts	Stiff	
8	Motor directions (Initial flight)	As mentioned in flight manual	
9	FPV camera	Live feed	
10	Strobe light	Blinking	

0.4.2 Inflight checklist:

In-flight checklist			
#	Items	Pass criteria	Yes/ No
1	Voltage	No drastic decrease in voltage	
2	Current consumption	Should not be more than 30 Amps in full payload condition	
3	Vibrations X	Should not cross beyond 10	
4	Vibrations y	Should not cross beyond 10	
5	Vibrations z	Should not cross beyond 30	
6	GPS satellites	Should be more than 10	

0.4.3 Post flight checklist:

Post flight checklist			
#	Items	Pass criteria	Yes/ No
1	Propeller bolts Tightness	Tight	
2	Landing gear bolts	Tight	
3	Motor balance	Propellers has to be in a plane	
4	Motor temperature	Should not exceed 60 degree Celsius	
5	Arm connector bolts	Bolts tightness	
6	Landing gear	No damage	



7	Battery plate Knob	Tight	
8	Battery sliders	Tight	
9	Battery Velcro	Tight	



Chapter 1: Operating Conditions/Limitations

1.1 Do's:

- Pilots should always fly under 400 feet at all times.
- Pilot should always maintain visual line of sight with drone
- Pilots should fly only when the wind speeds are less than 8m/sec.
- Whenever the Kaushalya drone is transported to a new location, the compass should be calibrated without exception. The drone should also be operated strictly in accordance with the guidelines written in this manual.
- Pilot should maintain a record of preflight checklist for every flight
- Pilot should follow the maintenance procedure without fail
- Pilot should monitor telemetry during the flight using the Inflight checklist provided along with this manual

1.2 Don'ts:

- Do not fly in severe weather conditions that include but are not limited to rain, dust, storms, fog that can interfere with visibility.
- Do not fly near High Voltage power lines.
- Do not fly near HIRF regions.
- Do not fly beyond visual line of sight
- Do not miss any preflight checklist provided along with this manual
- Do not intentionally or unintentionally submerge the drone as it lacks an IP rating

CAUTION

DO NOT FLY THE UAS WITH TOW MORE THAN MTOW i.e 2.2 KG
DURING NIGHT FLYING, ENSURE THE ALTITUDE IS LESS THAN 60 METERS
THE UAS SHALL NOT TAKE OFF IF NOT CONNECTED TO GCS
DO NOT CLOSE THE GCS DURING OPERATION. THIS WILL TRIGGER RTL
BY DEFAULT ANTI-COLLISION LIGHTS & STROBE LIGHT WILL BE ALWAYS ON UAS.
KAUSHALYA UAS IS NOT EQUIPPED WITH SHOCK ABSORPTION MECHANISM.

Note:

As Kaushalya UAS is not equipped with a shocking absorption mechanism. Follow the instructions attached here below.

1. Descent the UAS slowly preferably less than 0.2 m/s during touchdown of the UAS
2. The structure is designed in such a way to absorb the shock loads higher than 2g during hard landing.
3. If any failure in the landing gear is absorbed during operations, contact the Ikushal support team for assistance immediately.

Chapter 2: Operating procedure

2.1 Ground Control Station (GCS) Software's & Version:

Kausalya drone supports the following GCS Software's

1. **QGroundControl (QGS) :**
 - a V 4.0 Download link for windows [here](#).
 - b V 4.1.1 Download link for Android [here](#)

You can click on the above links to download and install the software on your phone, laptop & tablet.

2.1.1 The Ground control software name & Version number:

- The Ground control software used for the Kaushalya UAS is “**Qground control**” The link for the Android is [here](#) . The link for the windows is [here](#).
- Qground control is an open source software. It is available in Google play store and Google chrome for Laptops, the links for both are mentioned in the above step.
- The version for the Qground control is '**V4.1.1 64-bit version**'.

- **THE UAS HAS TO BE FLOWN WITH THE V 4.1.1 ONLY AND SHALL NOT BE FLOWN WITH ANY OTHER VERSION**

2.2 Connecting to Radio Controller with Master controller:

2.2.1 Connecting to the Radio controller from QGC on the phone with Master RC.

- Power on the Radio controller by a short press followed by a long press of the power button on the master RC.

- **THE GCS WILL CONNECT TO THE MASTER RC ONLY.**

- **WITHOUT GCS FLIGHT IS NOT POSSIBLE.**

- Turn on Bluetooth in your mobile phone
- Open QGC
- Follow: Home Tab (Q Button on top left) > Application setting > Comm Link> Add • In the pop up, enter a name for your drone. Example: 'My Kausalya drone'.
- Select 'Type' as 'Bluetooth'
- Select 'Scan'
- Making sure Bluetooth is on, wait for T10 to appear. On Training solution T10 Bluetooth name appears as 'Master'
- Select 'T10_XXXX' or 'Master'
- Select default parameters for the rest of the options
- Select 'OK'
- Your drone is added to your comm links now. Navigate to that section every time you want to connect to your drone
- Select the name of your drone in the comm links section
- Select Connect
- If asked for a Bluetooth pin, enter 1234.
- Please wait until the parameters download.
- Now your mobile is connected to a Radio controller.

2.2.2 Connecting to the Radio controller from QGC using USB cable with master RC.

-This section describes the procedure to connect radio controller from QGC to USB cable

- Power on the Radio controller by a short press followed by a long press of the power button on master RC.
- **THE GCS WILL CONNECT TO THE MASTER RC ONLY.**
- **WITHOUT GCS FLIGHT IS NOT POSSIBLE.**
- Use a USB Type-B cable to connect the laptop to the controller.
- Open Device Manager and identify the port number for your controller. (Ex: COM##)
- Open QGroundControl
- If your drivers are installed properly, QGC will automatically connect to telemetry
- In case it doesn't connect, go to Home > Application Settings > Comm Links > Add
- Enter a name for your drone. Example 'My Kausalya'
- Select Type as Serial
- Accept default Settings and select 'OK'
- Your drone is
- Your drone is added to your comm links now. Navigate to that section every time you want to connect to your drone
- Please wait until the parameters download
- Select 'Connect'.
- Now your device is connected to Radio controller

2.3 Flight Modes

2.3.1 Loiter:

In loiter mode the drone will automatically maintain the current position, heading and altitude. When operating in loiter mode, the pilot can control the copter manually, but upon releasing the controls, the vehicle will come to a stop.

Ref [loiter-mode](#)

2.3.2 Position Hold

The Position hold flight mode functions much like Loiter, with the vehicle retaining a stable location, heading, and altitude. Pilot stick inputs directly influence the vehicle's lean angle, delivering a more intuitive experience.

Ref [posholdmode](#)

2.3.3 Auto

In Auto mode the copter will follow a pre-programmed mission script stored in the autopilot which is made up of navigation commands

Ref [auto-mode](#)

2.3.4 RTL

RTL mode Navigates the drone from its current position to the launch position.

Ref [rtl-mode](#)

2.4 Radio Controller Functions and Auxiliary Switches

2.4.1 Radio Controls:

2.4.1 (a) Buddy system:

- There are 2 data links on Kausalya UAS. 1- Master controller & 1- Slave controller.
- The GCS master controller is connected to the master RC.
- Master RC has the authority to switch the control from master to slave.
- Only the master has the authority to take control back from the slave.



Below table lists the details of function in each control stick

#	Axis	Function	Action
1	X1	Yaw	Rotates around its own axis
2	Y1	Throttle	Controls the altitude of the drone
3	X2	Roll	Moves right or left
4	Y2	Pitch	Moves forward and backward

2.4.2 Auxiliary Switches:

Using the image as reference from previous section, following table lists the details of auxiliary function in each toggle switch

#	Axis	Function	Action
1	A	Master/Slave	To toggle between master and slave controllers
2	B	-	-
3	C	-	-
4	D	-	-

5	E	Flight modes	Changes between flight modes. Loiter, Auto & Poshold
6	F	RTL	Performs return to launch action

You can configure these modes here. Home tab > Vehicle Setup > Flight modes. Seek guidance from manufacturer before making changes to the default configuration

Buddy system: If the drone is integrated with master and slave configuration. In the master controller if we click on button “A”; the control of the drone will pass from the master to the slave. On clicking the button “A” again, the control will be taken back.

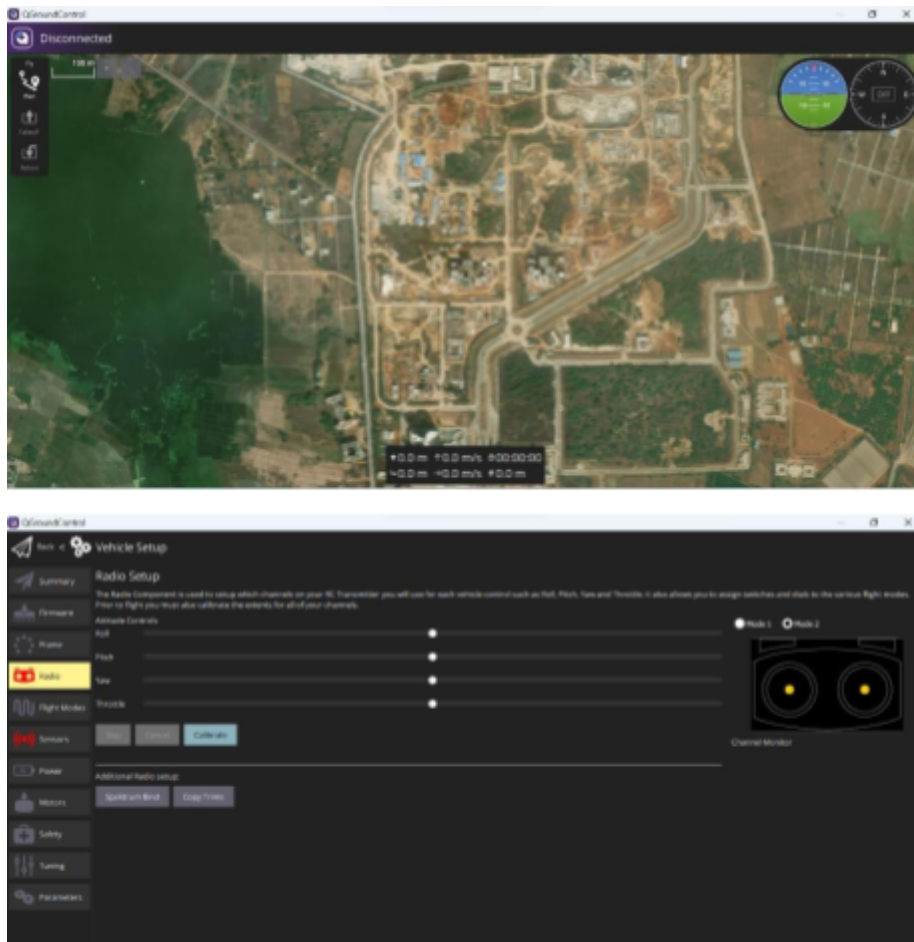
2.5 Calibration

NOTE: Calibration of the drone is a very sensitive activity. It affects the performance of the drone. Improper calibration may lead to loss of drone. Please be careful while doing the calibration.

NOTE: Compass calibration is mandatory when you move to a completely new geographic location (Usually over 200 Kms) or when you receive the drone from manufacturer, it is recommended to perform compass calibration in your local area before flying

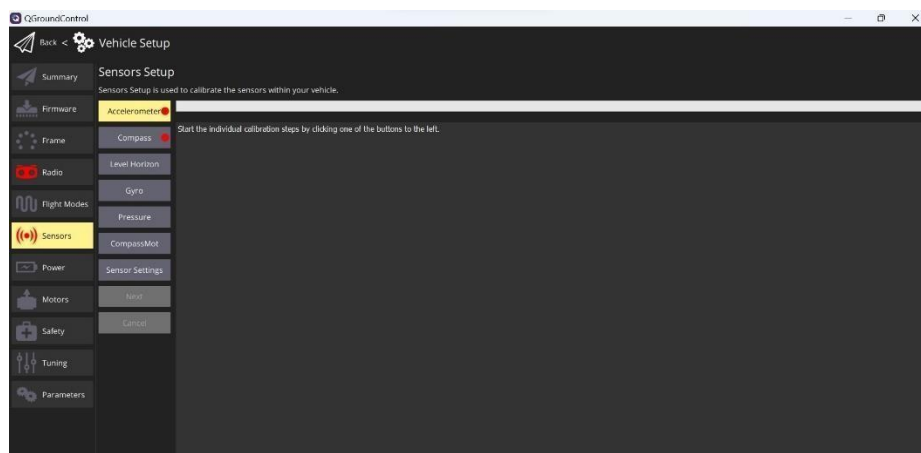
2.5.1 Radio Calibration for Master RC.

- The calibration of the radio has to be performed only on master RC.
- The identification of Master radio can be done by checking the labeling stickers.
- Click on Home button in QGroundControl main screen
- Go to Vehicle Setup > Radio > Calibrate
- You will find the calibration option at the bottom portion of the screen and click on “OK”.
- Move the joysticks according to instructions given in QGroundControl.
- Click on “Ok “after completion of Radio Controller calibration.
- Reboot the drone



2.5.2 Accelerometer

- Click on Home button in QGroundControl main screen
- Go to Vehicle Setup > Sensors > Accelerometer> Calibrate
- Follow the instruction on the screen
- Click on “OK” after completion of accelerometer calibration.
- Reboot the vehicle after completion of accelerometer calibration.



2.5.3 Compass calibration

- Click on Home in the QGroundControl main screen
- Go to Vehicle Setup > Sensors > Compass > Calibrate
- Hold Kausalya drone with 2 Hands and rotate 360 degrees in X, Y and Z axes. Once clockwise and once counter clockwise
- Keep rotating until the calibration bar is full

- If the QGC screen shows the calibration status as green, you can consider the calibration to be successful.
- If the QGC screen doesn't show green, contact Kushal innovation and incubation foundation.
- Click "OK" after completion of Compass calibration.
- Place the Kausalya drone on the ground and reboot.

2.5.4 Level horizon calibration

- Make sure the Kaushalya drone is on a level surface before proceeding
- Click on Home in QGroundControl main screen
- Go to Vehicle Setup > Sensors > Compass > Calibrate
- Wait for a success message. Do not move the drone during the calibration.
- Reboot the drone

2.6 How to power on:

- Power up the radio controller by pressing the power button twice on the master controller. (Slave controller is optional; use only if buddy system is required).
- Connect to the telemetry as described in section 2.2.
- Power up the drone by connecting battery cables (Make sure the XT90 connector is connected properly and there are no loose wires).
- After connecting the battery the LEDs tend to blink at high frequency at random intervals. Wait until they blink at constant intervals (usually 2 seconds).
- The Kaushalya drone should not be moving at all during the boot time. But this is not always possible when we are connecting battery wires. Therefore, prior to take-off, ensure a mandatory reboot from the telemetry screen.
- To reboot from the telemetry screen of QGC, Go to Home Tab > Parameters > Tools > Reboot.

2.7 Takeoff & Landing

2.7.1 Arming:

NOTE: Make sure all the sensors on board are calibrated

After the drone is powered on and the telemetry screen is connected perform the following tasks to arm the drone

- The arming of the drone can be done from the master controller & Slave controller.
- If button A has not been activated the master controller has the control of arming the UAS
- When button A is activated the slave controller can arm the drone.
- Make sure you do all the preflight checklist given by manufacturer before trying to arm
- Stand away least 4 feet from the drone
- Change the mode of the Kaushalya drone to Loiter
- When a green light flashes on the GPS module, it is ready to arm.
- Hold throttle stick down and Yaw right to arm the drone (Yaw left to disarm)
- Once armed, GPS led will become solid green indicating that the drone is armed and the motors start spinning.
- Continue to hold the throttle down for 5 seconds to disarm the drone.

2.7.2 Take Off:

After the drone is armed as described in the previous section

- If button A is not activated, only the master controller can perform take-off
- Activate button A to hand over control of the UAS to the slave controller. This allows the slave controller to perform take-off
- While still keeping the drone in loiter mode, get the throttle stick to center gradually
- You will notice an increase in RPM when you reach the center throttle
- Leave the stick at the center till you are comfortable to take off
- Gently push the throttle stick to 60% to take off.

While increasing throttle, ensure not to hold the throttle at 5-% for too long as it could cause instability in take off.

2.7.3 Land:

While in loiter mode

- Gradually lower the throttle sticks below the center position and hold once you reach desired descent rate
- Pull down the stick gradually to maintain the descent rate. Be careful not to pull the stick too much.
- Once the drone touches the ground, pull the throttle stick completely down.
- Hold yaw left to disarm

2.8 Mission Planning

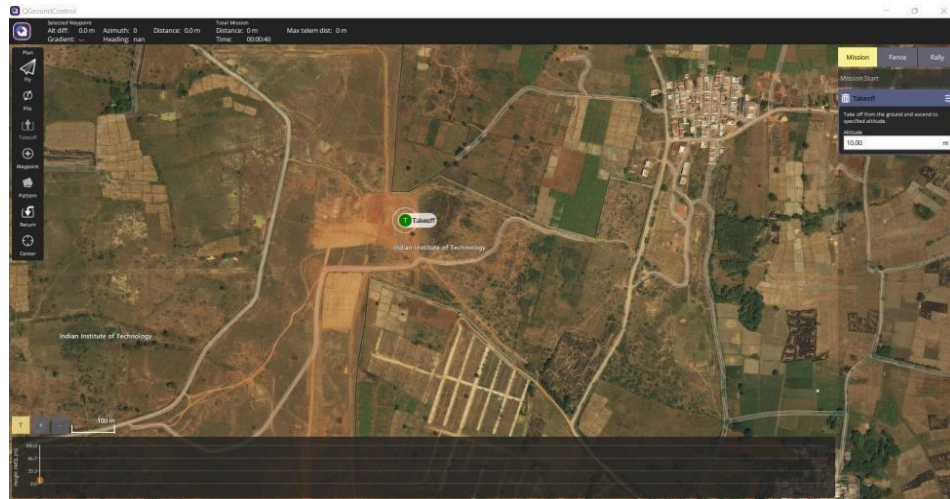
2.8.1 Automatic way points:

Once connected to the drone,

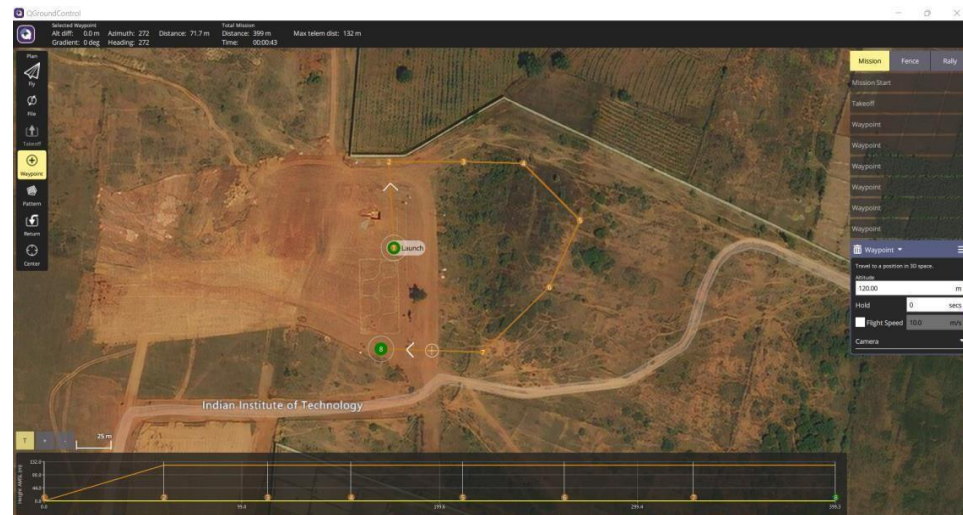
- Go to plan view from the main screen as shown in the below image



- Select take off on the left and enter take off altitude in the mission item on the right. Select a point on the ground where you wish to take off.



- Select Waypoint on the left and add waypoints tracing the path you wish the drone to follow . You can change the altitude along the waypoints.



- You can either add a return to launch waypoint or manually trigger RTL on the remote control once your mission is complete
- Hit upload on the top right once done. Wait for the update status to show 'Done'

Please make sure that there are no obstacles in the path of the drone when triggering RTL or planning automatic missions. Google maps have visible offsets and usually are not up to date. So please do the site inspection before you proceed carefully. If you are a beginner, you can contact Kausalya team for reviewing the mission plans initially

2.9 How to execute an AUTO Mission?

Follow the instructions below,

1. Plan the mission carefully and upload it to the drone
2. Arm the drone in loiter mode from the master controller.
3. Take off manually to desired and safe height if take off point is not included in the mission plan
4. If take off point is included, once armed switch the flight mode to 'Auto'
5. Raise the throttle stick to start executing the Auto mission

2.10 How to power-on camera?

2.10.1 How to power on CB-RUNCAM?

The power on button can be found on the top as shown in the image. The pilot should long press till the LED blinks and stabilizes to green. Pilot should repeat the same to power off the camera. A long press until the camera LED lights blinks blue.

For the data storage and video recording there is an external memory card that has to be placed in the camera to capture the feed in the memory card.



2.10.2 How to power on a CB-camera?

Upon observing the CB camera, the camera will be attached to the drone using a simple HT Allen bolt of M6. Pilot / Customer has to tighten the bolt to assemble the camera to the drone. A 3 pin connector will be coming out of the drone which is under the drone to connect to the camera directly. Upon plugin of connector. The camera gets powered on by its own, if the drone has the power up.

2.10.2 (A) How to use FPV camera:

1. The FPV camera is attached permanently to UAS.
2. The FPV will be used along with the Skydroid FPV app.
3. Once the drone is powered on, The FPV camera will be automatically powered by itself.
4. The pilot has to plug in the USB cable from the mobile to the Radio controller.
5. After connecting the Skydroid app will pop up automatically. This has to be used as a separate screen for feed from FPV to GCS.
6. The FPV will be directly connected to the radio transmitter. Feed will be continuous.

2.10.3 Replacement of RUNCAM & Ajeet EO-IR to UAS.

Ajeet EO-IR replacement SOP:

1. The Ajeet EO-IR will be assembled to the UAS with the help of a bolt to the base plate of the UAS.
2. The Electrical connections will be present to the UAS all the time.

3. The camera can be connected to the UAS at any point of time by untightening the bolt and replacing the Ajeet EO-IR.
4. The image of the Ajeet EO-IR is attached below.



Image: Ajeet EO-IR camera.

RUNCAM replacement SOP:

1. The RUNCAM uses the same camera mounting on to the base plate of the UAS.
2. A Bolt will be used for assembling the camera to the drone.
3. Upon using Allen key M5 with Nose plier will replace the UAS camera.
4. The RUNCAM camera image is attached below.



Image: CB-RUNCAM.

Chapter 3: Specifications

Manufacturer		Kushal Incubation and Innovation foundation
Model Name		Kaushalya Drone
1.	Physical Characteristics	Specification/Remarks
a.	Role of RPA	Training
b.	RPA maximum take-off weight	2200 grams
c.	Physical Dimensions	540mm x515 mm x 220 mm
2.	UAS Performance Characteristics	Specification/Remarks
a.	Endurance per flight	25 minutes of operational time with payload**
b.	Range	VLOS
c.	Maximum operating altitude	120 m AGL
d.	Working Temperature Range	-10°C to +50°C
e.	Wind Resistance	Up to 8 m/s
f.	UAS Maximum operational speed	8 m/s
g.	UAS Battery capacity	10,000 mAh 4S Battery
3.	Operational Characteristics	Specification/Remarks
a.	Launch	Vertical Take-Off and Landing
b.	Flight Modes	- Position Hold, Loiter Mode - Autonomous Waypoint Navigation Mode (AUTO Mode) - Emergency Return to Launch Mode
c.	Propulsion System	Electric propulsion system
d.	Failsafe (FS) features	- Return to Home on Communication Failure - Warning of low battery @ 35% Battery capacity - Return to Home @ 25% Battery capacity
e.	Geofencing capability	Yes, RTL on breaching Geo Fence

f.	Altitude Fence	Yes, UAS will not fly above 120 meters
g.	Packaging	Standard Casing for the RPA and peripherals
h.	Operating Crew	1-2 persons per system
4.	Communication Link Characteristics	Specification/Remarks
a.	C-2 Link	- Transmit control commands from GCS to UAV - Transmit telemetry data from UAV to GCS - Transmit the video feed from FPV camera to GCS.
b.	Frequency Band	2.4 GHz up-link and down-link
5.	Ground Control Station (GCS) Characteristics	Specification/Remarks
a.	GCS Hardware	Radio Controller
b.	Display	- Geographic Map along with UAV location, - Flight plan - Display of important parameters: - Battery capacity - Distance from home - Waypoints - Artificial Horizon indicating UAV attitude
c.	Maps	Standard google maps with selectable layers of satellite, street view.
d.	User Controls	- Set altitude of the UAV - Waypoint navigation - Dynamic flight plan adjustment - Position hold mode which allows UAV to be flown in semi autonomous mode
e.	Pre-flight checks	Integrated electronic pre-flight checklist
f.	Others	- Essential telemetry data logging. - Export of flight path in .kml format for reviewing in Google Earth
6.	Other Parameters	Specification/Remarks
a.	Hand Holding / troubleshooting	After sales support, the team would be available on phone as well as electronic email.
b.	DGCA operational guidelines	Support to customer in complying with the DGCA operational guidelines
c.	Warranty	One year

3.1 Technical Details:

3.1.1 Flight Control System:

#	Component	Details
1	Flight Controller	Pixhawk Cube Orange +
2	Battery	10,000 mAh, 4S Lithium Polymer
3	Propeller	10 , 45 Diameter inch
5	Radio Controller	Skydroid T10

3.1.2 Battery Operational Conditions:

#	Battery Status	Details
1	Battery low voltage	14.4 Volts
2	Battery mean voltage	14.8 Volts
3	Full battery voltage	16.6 Volts
4	Safe battery capacity consumption	70 - 75% of full capacity (7,000 to 7,500 mAh)

3.1.3 Failsafe Configured:

#	Failsafe	Action
1	Battery low voltage	The UAV will issue a warning only and no action is taken
2	Battery critical voltage	RTL is triggered immediately 14.4 Volts
3	Altitude Lock	120 meter AGL
4	Pre arm lock	Does not arm until GPS, Compass, Logging and Voltage checks are made
5	Radio link loss	UAV Will trigger RTH automatically by attaining the altitude of 10 meters height and lands vertically.

3.1.4 Battery storage instructions:

- Store battery in dry conditions.
- The ideal temperature range of storage condition is -10°C to 45°C.
- The battery should be stored above 15.2 Volts of charge.
- If the battery is stored below the limit, there is a chance of battery dead condition.

3.1.5 Battery charging procedure:

- The LIPO battery has to be charged in the balance charge all the time.
- If the battery is charged at a higher current the battery life will come down drastically. Hence Charging current should not exceed 10 Amperes.
- Initial step for the battery charging is to connect the battery xt-60 connector and the balance port cable to the corresponding ports on the battery charger.
- The balance port helps the battery to charge all the cells equally
- Select the balance charge in the battery charger
- Next select the ampere as 10 amps.
- Cell is 4S.
- Make sure you long press the button to start charging.
- The display will indicate each cell voltage during the charging.
- If the cells are not charging equally, kindly remove the battery from the charger and keep the battery away from the usage.

3.1.6 Battery safety precautions:

Before charging/ discharging:

- Inspect the battery for any damages. Do not charge a damaged battery.
- Inspect the battery for any swelling. Do not charge a swollen battery.
- Inspect the battery for possible battery fluid leaks. Do not charge a leaking battery.
- Inspect the voltage for each battery cell. if the cell voltage is significantly lower than the normal voltage (3. 3V per cell) or voltage of each cell has a significant difference, the battery may be in defective condition. Do not charge the battery.
- Make sure the wire connection polarity is correct, do not short circuit the battery.
- Verify the lithium polymer charger is in good condition.

3.1.7 Disposal of old battery:

Procedure for Self-Disposal of Lithium Polymer (LiPo) Batteries:

- ❖ The first step is to contact the support team of Ikushal & inform them of the incident.
- ❖ According to the instructions passed by the Ikushal team, Pack the battery & Ship the battery to Ikushal's office nearby to dispose of the battery.

3.1.8 Geofence:

- Drone geofencing is a technology that uses virtual boundaries to restrict the movement of unmanned aerial vehicles (UAVs) or drones. It is a form of airspace management that is used to protect people, property, and airspace from potential risks associated with drone operations.
- For The UAS, the Geofence is set for 900 meters default for the UAS from the manufacturer.
- There are more Geofence types are present in QGroundControl:
 1. Circular Geofence
 2. Polygon Geofence.

3.1.9 Night Flying Standard Operation procedure

- When it is applicable:
- The night flying is usually meant flying of the UAS after sunset and before sunrise

A. How to identify the Navigation light & Anti-collision lights?

- There are anti-collision strobe lights present behind the drone. The color of the light will be white.
- The navigation lights are present at the left and right of the drone, in “Green “& “Red “color.
- The direction & orientation can be found out using the anti-collision strobe light & navigation lights.
- The navigation lights are integrated, the Green lights to the left side of the UAS & Red lights to the right side of the UAS. When we stand on the back side of the UAS.
- Below is the image to understand more about anti-collision strobe lights & Navigation lights.



Image: Real time flying at night.

B. How to Identify the direction and orientation during night flying of UAS?

- The anti-collision strobe light will be integrated behind the UAS.
- We can fly the UAS till 300 meters from the take-off position of the UAS.
- When the UAS is flying at a certain range, the red and green lights will let us know the direction of the UAS.

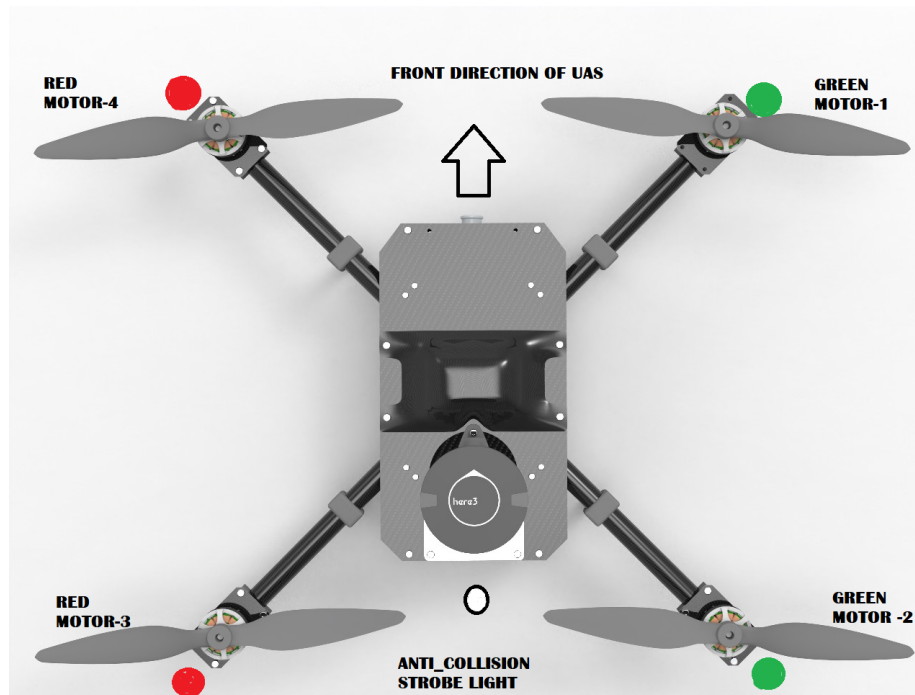


Image: Schematics of ANTI-COLLISION STROBE LIGHT & NAVIGATION LIGHTS.

- **Example-1:** While flying the drone, if the red lights are visible on the left and the green lights are visible on the right, that would indicate that the pilot is in line with the drone or pitching the drone forward would move it away from the pilot.
- **Example-2:** While flying the drone, if the green lights are visible on the left and the red lights are visible on the right, that would indicate that the drone is facing the pilot or pitching the drone forward would move it towards the pilot.

C. Emergency conditions during night flying:

Follow the following protocols in addition to those mentioned in daytime flying.

- If the lights are not visible, do not fly. Pilot should hit RTL immediately.
- When RTL is triggered, check the flying path to make sure there are no obstacles.
- Make sure one is around the Landing pad of the UAS to make sure the safe landing of the UAS.

D. Allowable range of the UAS during night flying:

- The pilot should ensure a 300 meters' visibility of the Anti-collision strobe light, Navigation light before flying.
- If the pilot is unable to see the navigation lights and anti-collision strobe lights. In this situation, the pilot should contact the Ikushal support team to get assistance on the UAS.

CAUTION

- The drone should always be within 300 meters of the pilot
- The drone should not cross 60 meters' altitude from the ground level.
- Without Anti-collision strobe lights and navigation lights the UAS is not meant for night flying.
- Before Takeoff pilots should ensure that navigation lights are glowing on the UAS before flying.
- Maximum height/ Vertical distance: 60 meters
- Maximum range/ Horizontal distance: 300 meters
- If you need any support, please contact the Ikushal support team for rectifying the problem.

Chapter 4: Emergency operating conditions

4.1 Loss of Communication:

In the loss of communication with GCS., the UAV will execute the RTL /RTH function automatically.

4.1.1 The action items of the pilot during the loss of connection with GCS to the master controller.

When the connection is lost the drone will first move to an altitude of 10 meters (fixed) and then execute the RTL command. In case it already is above an altitude of 10 meters it will directly execute RTL command

- Pilot should make sure that no obstacles are present in the path of UAV performing the RTL command
- No obstacles have to be present on or near the helipad of the UAS to make sure for the safe landing of the UAS.

4.1.1 (A) Loss of master to GCS:

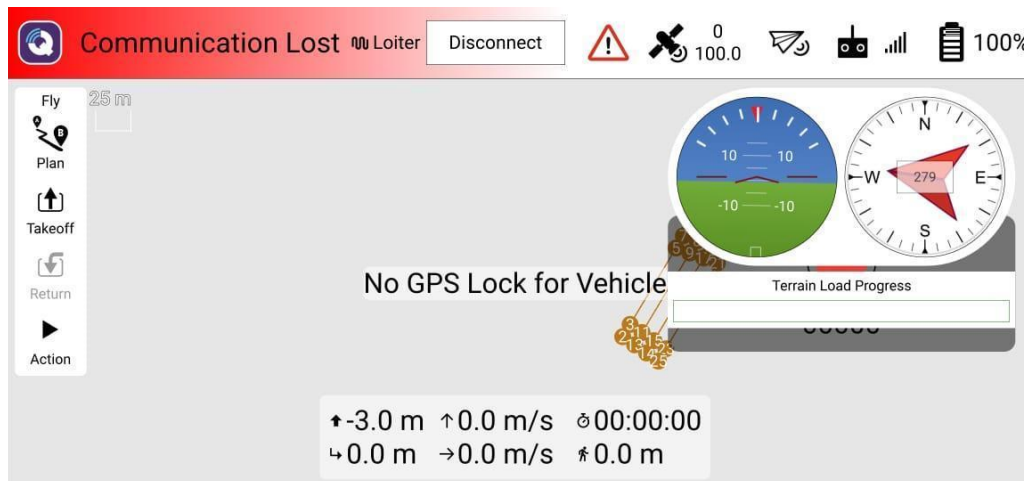
- If the loss of communication is observed on the GCS, The UAS will trigger RTL in 5 Sec after.
- Pilot has to just clear the landing area to make a safe landing in the UAS.

4.1.1(B) Loss of slave to UAS:

- If the loss of communication is observed on the GCS, The UAS will trigger RTL in 5 Sec after.
- Pilot has to just clear the landing area to make a safe landing in the UAS.

4.1.1(C) Loss of GCS:

- If the GCS is closed accidentally or unexpectedly the UAS will trigger RTL within 5 Sec.
- Pilot has to just clear the landing area to make a safe landing in the UAS.



4.2 Loss of stability:

If you observe instability in the Kausalya drone, such as uncontrolled yawning, disorientation, or wobbling, promptly activate the RTH mode using your Radio controller/Ground Control Station. If RTH is ineffective, safely land the aircraft, ensuring the descent path is obstacle-free.

4.2.1 Pilot action items in loss of stability:

-Pilot should make sure that no obstacles are present in the path of UAV executing the RTL command.

-No obstacles have to be present on or near the helipad of the UAS to make sure for the safe landing of the UAS.

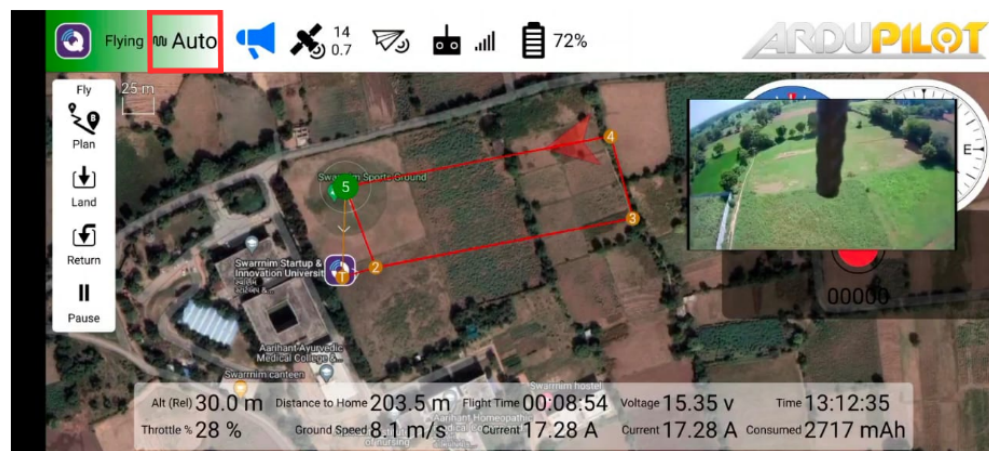
-The pilot should check for vibrations as mentioned in the checklist

-If the pilot observes that the stability is low for the UAV, they should land the drone immediately using the radio controller provided along with the UAS.

-The incident has to be reported after the landing of the drone to Ikushal team to support over the incident.

4.3 If Modes are not working in Transmitter:

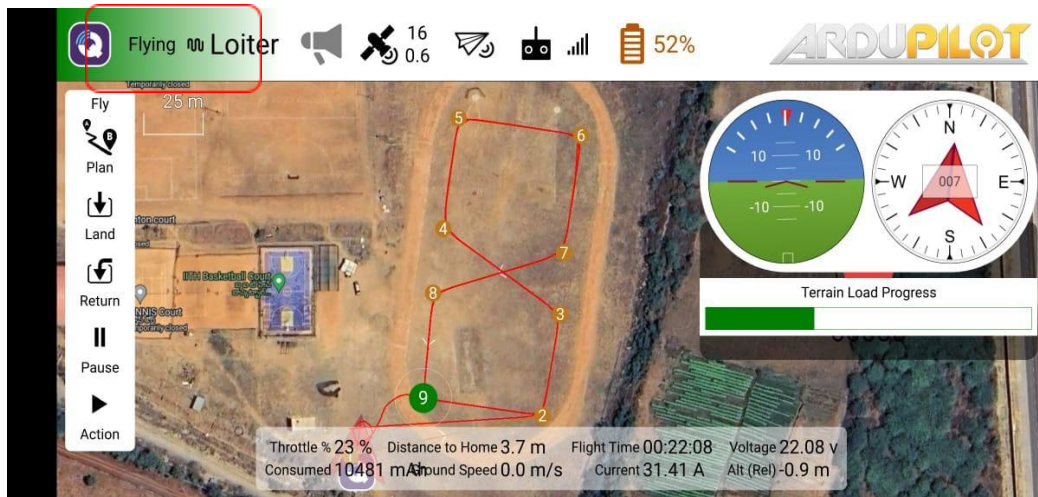
In case of modes not working from the Transmitter, Pilot can trigger the RTL from the QGround control software directly to make the drone come to home position safely. Below is the image shows for the modes changes can be made in the Qground control software.



After the mode is changed from the Qground control software or from the transmitter, The UAV takes 1-2 seconds of time to start coming back to RTH.

4.3.1 Pilot action items if modes are not working:

- Pilot should make sure that no obstacles are present in the path of UAV executing RTL command
- No obstacles have to be present on or near the helipad of the UAS to make sure for the safe landing of the UAS.
- In case of the modes are not working from the radio controller, Pilot has the option to control to UAS from the Ground control station.
- If you observe in the image below, The LOITER mode can be changed to the RTL function by clicking on the modes change in the GCS.
- This can enable the mode switch and UAS will automatically trigger RTL and Lands safely.
- In this situation, after landing please contact the Ikushal support to rectify the problem.



Chapter 5: Performance

The table given below outlines the performance of Kausalya drone in the minimum and maximum operational envelope for the different parameters given below.

Max Take-off weight	N/A	2200 grams
Maximum Speed	0 m/s	8 m/s
Endurance	N/A	27 minutes
Operational altitude	N/A	120 m AGL
Take off Altitude	0	4500 meters
Centre of gravity offset from center of RPA	0	10 cm
Wind speed	0	Up to 8 m/s
Temperature	-10 degrees Celsius	+50 degrees Celsius
Range	0	900 meters

5.1. Life of items:

Life of propeller	5000 flight hours
Battery	300 cycles (charging & discharging)
Life of air frame	5000 flight hours
Max permissible landings	5000 landings

5.2 List of critical items:

1. Top carbon fiber plate -1
2. Bottom carbon fiber plate -1
3. Landing gear tube -4



Chapter 6: Warranty clause

Warranty is applicable if:

1. If the manufacturer claims the incident happened because of a manufacturing defect, Warranty can be claimed.
2. First party insurance is mandatory for the claiming of warranty.
3. Maintenance schedule has to be followed to claim warranty.
4. Warranty is applicable for 1 year or 300 landings whichever is earlier.
5. UAV has to undergo maintenance for every 4 months in the first year.
6. Consumables like propellers and batteries are not covered under warranty.
7. The logistic charges have to be borne by the customer during the maintenance.

Warranty will be void if:

1. If a customer tries to tamper with the drone, Then the warranty will be void.
2. If UAV doesn't not undergo maintenance for every 4 months during warranty period, then the warranty is void.
3. Warranty is void if a drone is found to be flown inside closed structures or buildings, residential, commercial, industrial etc.
4. Warranty is Void if flown with any of the default fail-safes disabled
5. Damage caused by any modification of circuit, mismatch or misuse of battery and charger, improper installation, incorrect use or operation