# UBIFLY TECHNOLOGIES PVT LTD

# MAINTENANCE MANUAL

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| | Ubifly Technologies Pvt Ltd<br>Chennai, India |

| Prepared By | Checked By | Approved By |
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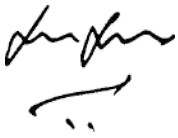
|  |  |  |
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## Record of Revision

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| 21.01.2024 | 1 | Formatting Changes. Added Checklist for critical component changes |
| 09.02.2024 | 2 | Formatting Changes. Minor language corrections all through the documents |
| 02.05.2024 | 3 | Updated Component Change SOPs to also include Software linked |
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# 1.Introduction:

## 1.1.Purpose of the maintenance manual

Regular or constant usage of components with moving parts and electronics causes wear and tear. So to ensure that drones continue to offer optimal performance and to ensure flight safety; it is recommended that comprehensive maintenance be performed after every flight or after certain flight hours. This manual is intended to advise to implement a routine maintenance programme on a per-flight basis rather than set dates in the calendar and maximize its continued reliability. This manual gives detailed instructions on inspection and maintenance procedure, response to damage of drone.

## 1.2.Drone make and model:

Vihaa

## 1.3.Serial number:

SERIAL NO

## 1.4.Date of manufacture:

5th November, 2023

## 1.5.Owner/operator:

COMPANY NAME / MODEL

## 1.6.DGCA registration number:


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# 2. Safety information:

## 2.1. Safety precautions:

**Soldering Safety**

1. **Element Temperature**
   - **Caution**: The element of the soldering iron can reach temperatures of 400°C or higher.
   - **Action**: Never touch the element to avoid severe burns.
2. **Handling Wires**
   - **Caution**: Heated wires can cause burns.
   - **Action**: Use tweezers or clamps to hold wires while soldering to prevent direct contact with heated elements.
3. **Cleaning Sponge**
   - **Caution**: A dry cleaning sponge can cause the soldering iron to overheat.
   - **Action**: Keep the cleaning sponge wet during use to ensure efficient cleaning and temperature control of the soldering iron.
4. **Soldering Iron Stand**
   - **Caution**: Placing the soldering iron directly on the workbench can cause fires or accidental burns.
   - **Action**: Always return the soldering iron to its stand when not in use to prevent accidents.
5. **Power Management**
   - **Caution**: Leaving the soldering iron on and plugged in when not in use can lead to overheating and potential hazards.
   - **Action**: Turn off and unplug the soldering iron when not in use to ensure safety and energy efficiency.

### Hygiene Standard

1. **Eating, Drinking, and Smoking**
   - **Caution**: Consuming food, drinks, or smoking while handling disinfectants can lead to ingestion or inhalation of harmful substances.
   - **Action**: Do not eat, drink, or smoke while using disinfectants to avoid contamination and health risks.
2. **Measuring and Mixing Disinfectants**


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- **Caution**: Improper handling of disinfectants can cause spills, splashes, and exposure to harmful chemicals.
- **Action**: Use suitable equipment such as measuring cups, mixing tools, and transfer devices to handle disinfectants safely.

3. **Handling Liquids and Blockages**
   - **Caution**: Stirring liquids or clearing blockages with bare hands can result in direct exposure to disinfectants.
   - **Action**: Use appropriate tools like the pressure-release valve of the pump or a soft probe to clear nozzle blockages safely.
4. **Personal Hygiene During Operations**
   - **Caution**: Disinfectant residue on the skin can cause irritation or harm.
   - **Action**: Wash hands and face with soap and water each time the pump is refilled to remove any disinfectant residue.
5. **Eating and Drinking After Handling Disinfectants**
   - **Caution**: Residual disinfectants on the skin can be ingested with food or drinks.
   - **Action**: Eat and drink only after thoroughly washing hands and face to prevent ingestion of disinfectants.
6. **Post-Operation Hygiene**
   - **Caution**: Disinfectant residues can remain on the skin and clothing after operations.
   - **Action**: Take a shower or bath at the end of each operation to remove any residual disinfectants and reduce the risk of prolonged exposure.

## 2.2.Risk management:

### Compliance with DGCA Regulations

1. **Permission to Fly**
   - **Requirement**: Obtain necessary permissions from the Directorate General of Civil Aviation (DGCA) before operating a drone.
   - **Action**: Submit an application for flight clearance through the Digital Sky platform, providing details about the drone, the operator, and the intended flight plan.
2. **Visual Line-of-Sight (VLOS)**
   - **Requirement**: Drones must be operated within the visual line-of-sight of the operator at all times.


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- **Action**: Ensure that the drone is always visible to the naked eye, without the aid of binoculars or other visual enhancements, to maintain control and avoid collisions.

3. **Drone Registration**
   - **Requirement**: All drones must be registered with the DGCA and issued a unique identification number (UIN).
   - **Action**: Complete the registration process on the Digital Sky platform, providing necessary information about the drone and the operator, and prominently display the UIN on the drone.

## Regular Maintenance and Safety Checks

1. **Pre-Flight Inspections**
   - **Requirement**: Conduct thorough pre-flight inspections to ensure the drone is in optimal condition.
   - **Action**: Check all components, including motors, propellers, batteries, and control systems, for any signs of wear or damage before each flight.
2. **Routine Maintenance**
   - **Requirement**: Follow the manufacturer's recommended maintenance schedule.
   - **Action**: Perform regular maintenance tasks such as cleaning, and component replacements to ensure the drone operates safely and efficiently.

## Liability Insurance

1. **Insurance Coverage**
   - **Requirement**: Obtain liability insurance to cover potential damages or injuries caused by drone operations.
   - **Action**: Purchase a comprehensive drone insurance policy that covers third-party liability, property damage, and personal injury, tailored to the specific risks associated with your drone operations.
2. **Claims Management**
   - **Requirement**: Have a clear process for managing insurance claims.
   - **Action**: Familiarize yourself with the claims procedure outlined by your insurance provider and keep detailed records of all flights and incidents to facilitate efficient claims processing if needed.


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By adhering to DGCA regulations, conducting regular maintenance, and securing appropriate insurance coverage, you can effectively manage the risks associated with drone operations. This approach ensures compliance with legal requirements, enhances safety, and provides financial protection against potential liabilities.

## 2.3.Personal protective equipment

- Gloves
- Shoes
- Eye Protection

## 2.4.List of Critical Components and maintenance Inspection

| | DESCRIPTION | CHECK | Life of Component |
|---|---|---|---|
| 1 | Frame | Check for deterioration, cracks, & deformation. Replace if required. | 2500 flight hours |
| 2 | Arms | Check for deterioration, cracks, & deformation. | 2500 flight hours |
| 3 | Motors | Check for friction and free movement. | 500 Flight hours |
| 4 | Propellers | Replace propeller after 500 flight hours or replace if any crack or bend occurred. | 500 flight hours |
| 5 | Tank | Check for leaks and corrosion, cracks or scratches on the tank | 1 year |


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| | | | |
|---|---|---|---|
| 6 | Pump | Check for flow pressure | 500 operational hours |
| 7 | Landing gear | Check for any cracks, damage, loose fasteners, or signs of wear like deformation, bending | Replace landing gear after 3000 flights.<br>Replace if any crack and bend occurred. |
| 8 | Battery | Check for any bulges, leaks, Corrosion | Replace battery after 300 Charge Discharge Cycles |
| 9 | Landing gear connectors | Check for any cracks, damage, loose fasteners, or signs of wear like deformation, bending | To be discarded with the landing gear after completion of 3000 landing cycles. |
| 10 | Arm Sleeves | Check for any cracks, damage, loose fasteners, or signs of wear like deformation, bending | To be discarded with the Airframe after completion of 2500 flight hours |
| 11 | T-Joint Connector | Check for any cracks, damage, loose fasteners, or signs of wear like deformation, bending | To be discarded with the landing gear after completion of 3000 landing cycles. |

***Note:*** *Critical components of Arm Sleeve, landing gear connector, and T-Joint connectors will be disposed of along with the airframe and landing gear respectively. These components are integral to the overall structure and functionality of the airframe, and therefore, cannot be reused once the airframe reaches its end of life. All parts together constitute a unified frame, ensuring safety and performance standards are maintained.*


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# 3.Maintenance schedule:

Visual inspections are performed before and after every flight. They do not require a maintenance team. In case of a hard landing or crash, please refer to the maintenance team. Below is a table on the inspections schedule

| S. No | Name of the Component | Every Flight | Every Day of flight | Every Month | Every 6 months |
|---|---|---|---|---|---|
| 1 | Frame(body, arms, canopy) | ✔ | ✔ | | ✔ |
| 2 | Screws and joints(folding parts, locking cap, arm accessories kit) | ✔ | | | ✔ |
| 3 | Landing gear(vertical, horizontal, fixed seat of landing gear | ✔ | | | ✔ |
| 4 | Motors | ✔ | | | ✔ |
| 5 | Propellers | ✔ | | | ✔ |
| 6 | Flight controller | | | ✔ | ✔ |
| 7 | Transmitter & receiver | | | ✔ | ✔ |


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| | | | | | |
|---|---|---|---|---|---|
| 8 | GPS | | | ✔ | ✔ |
| 9 | FPV Camera | | | ✔ | ✔ |
| 10 | Obstacle Avoidance Sensors | | | ✔ | ✔ |
| 11 | Terrain Following Radar | | | ✔ | ✔ |
| 12 | Battery, battery plate, Velcro tape | ✔ | ✔ | | ✔ |
| 13 | pneumatic connecters(6*6 , 8*6, 12*8) | | ✔ | | ✔ |
| 14 | XT connectors(60,90), PMU | | | | ✔ |
| 15 | Tank, pump, water tube | | ✔ | | ✔ |
| 16 | Screws | | ✔ | | ✔ |

✔ - Scheduled Maintenance by Manufacturers

✔ - Scheduled Inspections by Operators

***Note: Battery must be replaced after 300 cycles***


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## 3.1. Inspection before every flight:

Visual Inspection should be carried out on a drone after every flight. Components that need to undergo this are

- Motors
- Propellers
- Battery plate and velcro tape
- Screws
- Frames
- Tank

## 3.2. Daily Inspection

At the end of every day of flight, the following visual inspection must be done to ensure smooth and safe operation of flight subsequently

- Battery (For swelling, leakage, damages)
- Frames and arms(Cracks, dents, wear and tears)
- Wires (Loose contacts, open ends, scratches)
- Tubes (Leakages, damages)
- Tank (Leaks, dents)

To ensure proper conditioning and performance, regular maintenance of the drone is needed. Further operational experience indicates that running maintenance set on flight hours/cycles or recurring on time leads to smoother and better performance

## 3.3.Monthly maintenance

- Flight controller (Calibration of IMU and Compass)
- Transmitter & Receiver
- GPS (Check GPS mounts for cracks)
- Camera (Clean the camera and check for Visual feed’s quality)


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- Terrain Following RADAR (Clean the RADAR and clear any Foreign Object Debris)

## 3.4. Every 6 months Maintenance

This maintenance which is periodically performed every 6 months is done by the manufacturer. During this a comprehensive inspection of the frame, propellers, landing gear, and electronics for signs of wear, damage, or corrosion. During this maintenance, all flight control systems, including the flight controller, ESCs, and GPS are checked and re-calibrated, if needed.

Post 6 month maintenance flight tests are conducted to assess overall performance and evaluate any maintenance tasks based on findings. Detailed records of all maintenance activities are logged. The details of the 6 months maintenance for the mechanical components are listed in Section 5.5 of this manual


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# 4. Inspection

## 4.1.Pre-flight inspection

Pre - flight inspection and maintenance procedure is given below. The Pilot and flight engineer shall inspect the following before the start of all flight operations:

- Verify that all arms are securely attached to the center frame and that the Arm waterproof rings are locked in place.
- Check for any motion between the locking cap of the arm and the folding mechanism.
- Ensure that the rotor frame is devoid of structural anomalies and loose or missing parts.
- Inspect the Locking cap of arm for any damage or wear to the carbon fiber tubes, paying close attention to the junctions at each end.
- Check for any motion between each motor mount and boom, and between the motor bell and base.
- Spin the motors by hand to check for smooth rotation and inspect the motor bells for any dents or scratches.
- Inspect the propellers for correct attachment to the hub with respect to the rotation of the motor,e.g, (CW Propeller- to- CW motor), pitch play and wear.
- Check the propellers' hinges for their rigidity
- Verify that the battery plate is securely attached to the airframe and that the landing gear is correctly oriented and attached to the airframe.
- Check that the GPS and control link antennas are securely fastened and correctly oriented.
- Verify that the RPA indication lights on the end of each boom are functioning properly.
- Inspect the payload attachment points and ensure that clamps are in place, if used.


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- Check the payload level
- Verify that all antennas are in good condition and correctly oriented
- Inspect the control sticks of the transmitter for free movement and check for dust or debris
- Verify that the propellers are clear of surrounding structures and other propellers as they rotate through their full range of motion.

## 4.2.Post-flight Processes

- Batteries should be disconnected soon after the flight to conserve power for the next flight and to avoid mishaps
- Check the battery energy levels immediately after the flight
- Temperature
    - Check the temperature levels of motor and battery post flight
    - Connectors to the battery and power input connectors' temperature levels
- Visually check the propeller for wear and tear and damage.
- Test and log the voltage of each battery pack and inspect the batteries for signs of damage or swelling.
- Inspect the battery connectors and leads for wear or damage and ensure all batteries are securely attached to the battery tray.


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# 5. Maintenance procedures:

**After every maintenance check and replacement, it is instructed to place a tamper-proof seal on the part**

## 5.1. Battery maintenance

Keep the battery contacts clean, as dirty or corroded contacts can lead to poor connections and reduced battery performance
Visually inspect the battery for any signs of physical damage, swelling, or leakage. If you notice any issues, discontinue use immediately

Please charge the Battery only with the PC1080 charger provided with the Drone and follow the instructions mentioned below carefully.

### 5.1.1. Battery Charging

#### 5.1.1.1. PC1080 Charger

Charging Operation

- Power on the charger: A beep sound will be heard alongside the LCD screen lighting up as follows:




- Battery Connection: Connect the mPower 6S 25200 mAh batteries to the PC1080 charger as follows:


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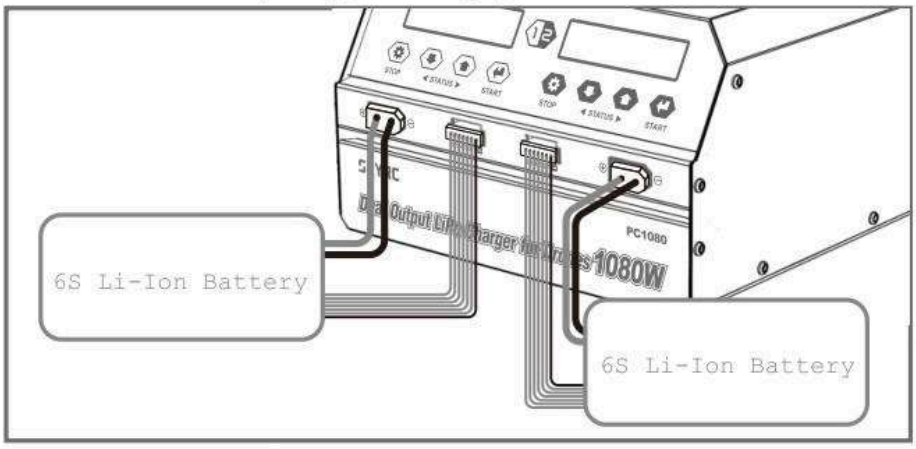
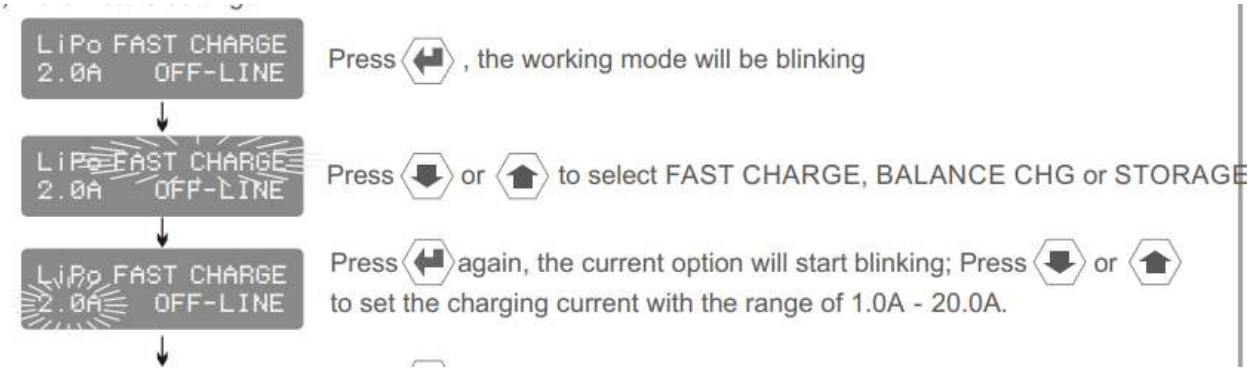
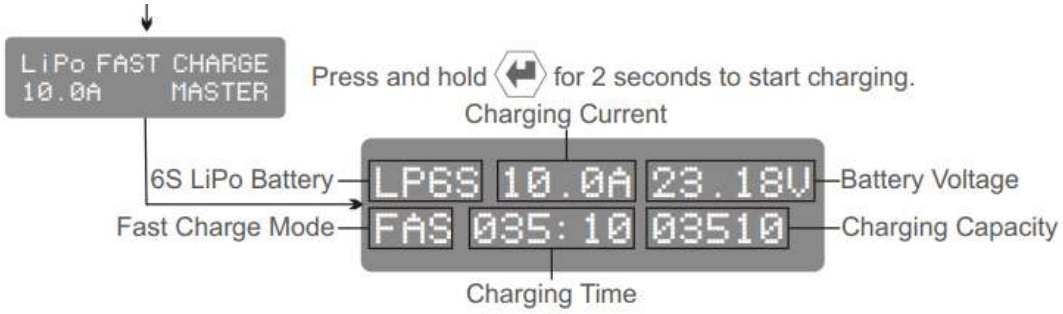



- Parameter Setting: Connect the mPower 6S 25200 mAh batteries to the PC1080 charger as follows:




For mPower 6S 25200 mAh, we recommend setting 20A as the max charging current

- Begin Charging:





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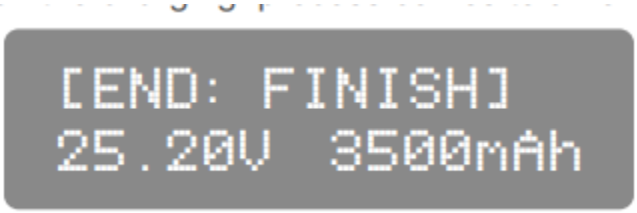
- Stopping:

Stop: if you'd like to terminate charging during the charging process, press . Under Master-Slave mode, any operation must be carried out on the Master channel.

- Finishing Charging: Once the Charging is complete, the charger displays the following




The following guidelines should always be followed when handling and charging the Li-Ion battery.

- Never leave the charger unattended when its connected to the power supply. In case of malfunction, please terminate the charging procedure at once
- Ensure the charger is away from dust, moisture, rain, direct sunlight, and vibration
- The battery should only be charged on a heat-resistant, non-inflammable and non-conductive surface.
- Never place them on a car seat, carpet, or similar locations. Keep all the inflammable and volatile materials away from the operating area.
- If the program is set up incorrectly, the battery and charger may get damaged. It can cause fire or explosion due to overcharging

- Once the battery has reached its full capacity, disconnect it from the charger and store it in a safe place. It is recommended to store the battery in a cool and dry place, and to charge it before use.

- Do not charge the battery near flammable products or liquids.
- Li-Ion batteries should be charged within a temperature range of 0°C to 30°C.
- Do not leave Li-Ion batteries unattended while they are being charged.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- Do not store the battery inside the vehicle.
- Do not charge Li-Ion battery packs at rates greater than 24A.
- Do not charge Li-Ion packs that have been overcharged, undercharged, or accidentally swollen or swollen.
- Do not charge damaged or accidently damaged lithium polymer batteries.
- Have a fire extinguisher near the loading area or a large bucket of dry sand. Do not try to extinguish the fire with water. Use Class D Fire Extinguisher
- If you notice the Li-Ion swelling, stop charging immediately, place the battery in a safe container and observe for 15 minutes


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| S .NO | PROCEDURE | CHECKLIST | REMARKS |
|---|---|---|---|
| 1 | Begin by connecting the Li-Ion battery to the charger using the XT90 ANTI SPARK connector. Make sure the connector is securely in place and the polarity is correct. | Yes ( ) / No ( ) | |
| 2 | Set the charger to the appropriate voltage and discharge rate for the battery. In this case, the voltage should be set to 21.6V and the discharge rate to 1C. | Yes ( ) / No ( ) | |
| 3 | Turn on the charger and start the charging process. The charger will automatically stop charging when the battery reaches its full capacity. | Yes ( ) / No ( ) | |
| 4 | During the charging process, it is important to monitor the battery's temperature to ensure that it does not overheat. If the battery becomes too hot, stop the charging process and allow it to cool down before continuing. | Yes ( ) / No ( ) | |
| 5 | Once the battery has reached its full capacity, disconnect it from the charger and store it in a safe place. It is recommended to store the battery in a cool and dry place, and to charge it before use. | Yes ( ) / No ( ) | |
| 6 | To ensure the battery maintains its performance, try to use it up to 50% of its capacity before recharging it. | Yes ( ) / No ( ) | |

## Handling swollen batteries

Handling swollen or bloated batteries requires careful attention to safety protocols to prevent injury or further damage. Follow these detailed steps to manage and dispose of swollen batteries safely:

### Before Removal

1. **Allow Natural Discharge**
    - **Caution**: Handling a swollen battery while it still has a charge can be dangerous.


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- **Action**: Allow the swollen battery to discharge naturally. Do not use the drone or any device to force discharge.

2. **Avoid Charging**
   - **Caution**: Charging a swollen battery can lead to overheating, explosion, or fire.
   - **Action**: Never place a bloated battery in a charger.
3. **Select an Appropriate Setting**
   - **Caution**: Swollen batteries can pose a fire risk.
   - **Action**: Choose a well-ventilated outdoor area for handling the battery. This minimizes the risk of fire and ensures you have ample space to maneuver.
4. **Remove Combustibles**
   - **Caution**: Combustible materials can easily ignite if the battery catches fire.
   - **Action**: Clear the area of any flammable materials to reduce the risk of accidental ignition.
5. **Wear Safety Gear**
   - **Caution**: Exposure to battery chemicals can be hazardous.
   - **Action**: Wear safety gear, including gloves, safety goggles, and long sleeves, to protect against potential chemical exposure or burns.

**During Removal**

1. **Use Plastic Implements**
   - **Caution**: Metal tools can create sparks, leading to fire or explosion.
   - **Action**: Use non-conductive plastic tools to handle and remove the swollen battery safely.
2. **Avoid Bladed Instruments**
   - **Caution**: Blades can puncture the battery, causing leakage or combustion.
   - **Action**: Do not use knives or other sharp tools to pry the battery loose.

**After Removal**

1. **Keep Away from Children**
   - **Caution**: Swollen batteries contain harmful chemicals and can be dangerous if mishandled.
   - **Action**: Store the removed battery out of reach of children and pets to prevent accidental exposure or injury.
2. **Store Safely**
   - **Caution**: Swollen batteries can still pose a risk of fire.


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- **Action**: Place the battery in a noncombustible container, such as a metal box or a special LiPo battery bag, to contain any potential hazards.

3. **Dispose Promptly**
   - **Caution**: Keeping a swollen battery can increase the risk of incidents over time.
   - **Action**: Take the battery to a certified recycling center as soon as possible. Do not dispose of it in regular trash or recycling bins, as this can pose a significant hazard.

### 5.1.2.Battery catching fire:

**Caution: Fire in Lithium family batteries is dangerous. The battery can explode causing injury, loss of life, property. Therefore, if the fire is large, do not go near Vihaa. If the fire is small, the following action are recommended:**

- Move the drone to a safe location if possible.
- Use a Lith-Ex fire extinguisher, or any other first aid fire extinguishing equipment if available nearby or by smothering. to put out the fire.
- Once the fire is off, then disconnect the battery, if it's safe to do so.
- Ensure the situation is under control before further actions.
- Do not attempt to fly the drone again until the cause of the fire has been determined and corrected.

**Fire accidents around the drone while flying:**

- If there is a fire accident around the drone operating/ flying area or in the vicinity, immediately bring the drone back to the ground.
- Land the drone as safely and as quickly as possible.
- Once the drone is on the ground, disconnect the battery and move the drone away from the fire to a safer location
- Do not attempt to fly the drone again until it is safe to do so.

### 5.1.3.Battery Storage and Transportation:

- Transporting and storing lithium-ion (Li-Ion) batteries safely is crucial due to the potential fire and safety risks associated with these batteries. Whether for personal


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use, commercial applications, or industrial purposes, following safety guidelines and regulations is essential. Here are some key requirements and best practices for storing and transporting Li-Ion batteries:

- Store Li-Ion batteries at a temperature range between 0°C to 25°C.
- Protect batteries from physical damage, such as punctures or crushing. Store them in a secure, stable location where they won't be subjected to mechanical stress.

  Store batteries in a dry and cool location, preferably in a non-conductive container or packaging to prevent contact with conductive materials that could short-circuit the battery.
- Ensure proper ventilation in storage areas to dissipate heat in case of thermal runaway. Do not store batteries in sealed or airtight containers.
- Store Li-Ion batteries with a charge level between 30% and 50%. Storing batteries at full charge or completely discharged for extended periods can lead to capacity degradation.
- Clearly label storage containers with information about the type and quantity of batteries stored and any relevant safety precautions.





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*Fig 5.1: The Lithium-Ion battery stored in a Li-Po safe bag*


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**Transportation Requirements:**

- When transporting Li-Ion batteries, use appropriate packaging that provides mechanical protection and electrical insulation.
- Follow regulations regarding the maximum quantity of Li-Ion batteries that can be transported in a single shipment. These limits depend on the battery's watt-hour rating and whether it's carried as carry-on or checked baggage on passenger aircraft.
- Li-Ion batteries should be transported with a state of charge between 30% and 50%. Some regulations may require batteries to be transported at a specific state of charge.
- Prevent short-circuiting during transport by insulating battery terminals with non-conductive material or tape. This is particularly important for loose or spare batteries.
- Be prepared for emergencies by having suitable fire extinguishing equipment and training personnel on how to respond to Li-Ion battery fires or incidents.
- Personnel involved in transporting Li-Ion batteries should receive training on the safe handling, packaging, and transport of these batteries.
- Always check the latest regulations and guidelines from relevant authorities and organizations, as they may evolve over time to address emerging safety concerns related to Li-Ion batteries. Additionally, consulting with experienced professionals or organizations specializing in battery safety and transport can provide valuable guidance.
- Do not leave the Li-Ion battery fully charged for more than 3 days (72 hours).
- Place the storage box on a cement concrete floor and horizontal clearance radius should be at least 2ft and vertical clearance should be at least 10ft.
- Store the Battery packs in a low temperature room (less than 25° C).
- Damage to a cell in a pack will permanently damage the pack and may cause a fire.
- Store the damaged battery in a cool, dry chamber to avoid smoke or flame.
- Fire extinguishers must be available during storage, transportation and loading.
- Store the battery pack in nominal voltage 3.6V (21.6V across the pack). This makes the pack last longer and less volatile.
- Keep Li-Ion battery packs out of children’s reach.


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- Do not put batteries in pockets or near conducting metal where they can short out.
- Do not store, transport, or carry the battery where it can come into contact with sharp or metallic objects.
- Do not store Li-Ion batteries in extreme temperatures below 0°C or above 35°C.
- Always store Li-Ion packs in safe, non-flammable containers and away from combustible materials.
- Avoid bulk-storage in non-laboratory areas such as offices.
- Always store Li-Ion batteries partially charged. They maintain their level of performance over time and do not need to be cycled unless stored for more than 3-6 months ideally.
- Visually inspect battery storage areas weekly.

## LONG TERM STORAGE

**If the mPower Batteries are to not be used for a long time, its required to discharge the battery to 3.6V/cell with Storage mode on the PC1080. If the voltage is >3.6V/cell, the battery will discharge while if its <3.6V/cell, the battery will charge**

**Long term Battery Storage checks**

Regular maintenance checks of lithium-ion battery packs used in a drones are of significance because:

1. Maintaining battery health and Prolonging lifespan.
2. Improving Operational Reliability.

How often should these checks be done?

**Monthly Checks**

- **Detailed Visual Inspection:** Check for any signs of aging or wear that might not be immediately apparent. This includes inspecting each battery pack for any physical damage, swelling, leakage or corrosion on terminals.


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- **Voltage:** Both Pack and cell voltage to be measured using a digital multimeter or a cell meter.
- **Self-Discharge Rate:** When the battery is idle, Check for any leakage currents if present, that may drain the battery unnecessarily.

**Quarterly Checks**

- **Comprehensive Review:** Review all the recorded data, including voltage, internal resistance, and physical condition logs. Check the consistency and trends in the data to identify any gradual changes or emerging issues.

**After Extended Storage** *(> 1 month)***:** If the battery has been stored for an extended period, conduct a comprehensive check before resuming regular use.

## 5.2.Motor and Propeller maintenance

### 5.2.1.Visual Inspection before every flight

**Inspect Propellers:**

- Check for visible damage such as cracks, chips, or bending.
- **Action:** Replace damaged propellers immediately.

**Verify Attachment:**

- Ensure propellers are securely attached to motor shafts.
- **Action:** Tighten if loose; replace fasteners if necessary.

### 5.2.2. Maintenance checks

**Temperature Evaluation:**

- Measure motor temperatures after each flight.
- **Action:** Ensure temperatures stay below 80°C to prevent overheating.


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**Motor Mounts Inspection:**

- Check motor mounts for proper installation and alignment.
- **Action:** Adjust mounts if misaligned; tighten screws securely.

**Resistance Testing:**

- Use a multimeter to check motor resistance periodically.
- **Action:** Replace motor if resistance is unusually high.

**Inspect Motor Base:**

- Verify even gap between motor and motor base.
- **Action:** Adjust base if gap is uneven; ensure tightness of securing screws.

**Rotor Check:**

- Examine rotors to ensure they are securely fastened.
- **Action:** Tighten rotor screws as needed.

**Connector Inspection:**

- Check soldered leads in connectors for proper condition.
- **Action:** Ensure connections are secure and wires are intact.

### 5.2.3. Signs for Motor Replacement

**Abnormal Noise Check:**

- Detach propellers and arm the motors; listen for unusual noises.
- **Action:** Replace motors if abnormal noise persists (indicative of worn bearings).

**Vibration Check:**

- Detach propellers and arm the motors; check for excessive vibration.
- **Action:** Replace motors if abnormal vibration is detected.

**Visual Inspection:**


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- Look for cracks or deformations on motors.
- **Action:** Replace motors if cracks or deformations are found.

**Record Keeping**

- Maintain a detailed record of all motor and propeller maintenance activities.
- Include dates of replacements, adjustments made, and any observations noted during inspections.

### 5.2.4. Payload maintenance

The payload system of the drone includes nozzles (4), pneumatic connectors (8), a pump (1), and the water & pesticide mixture. To prevent corrosion caused by pesticides, daily maintenance of the payload system is essential. Follow these steps to ensure proper maintenance:

1. **Preparation:**
    - Ensure the drone is powered off initially.
    - Gather fresh water, a clean cloth, and a thin brush for cleaning.
2. **Clean the Tank:**
    - Fill the tank with freshwater.
    - Reconnect the battery and power on the drone to activate the pump.
    - Toggle the pump switch to spray the fresh water, flushing out any residual pesticides and dust from the tank, nozzles, pneumatic connectors, and pump.
    - Repeat the flushing process if necessary to ensure all pesticide residues are removed.
    - Power off the drone and disconnect the battery after flushing.
3. **Dry the Tank and Sprayers:**
    - Use a clean cloth to thoroughly dry the inside of the tank.
    - Wipe down the exterior of the tank and sprayers to remove any moisture.
4. **Clean the Nozzles:**
    - Carefully remove the nozzles from the connected tubes.
    - Using a thin brush, gently clean the filters of the nozzles with water. Make sure to remove any debris or clogs that may have formed.


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- Rinse the nozzles thoroughly with fresh water to ensure they are clean.

5. **Dry and Reassemble:**
   - Use a clean cloth to dry the nozzles completely before reassembly.
   - Reattach the nozzles to the connected tubes securely.
6. **Inspect Pneumatic Connectors and Pump:**
   - Check the pneumatic connectors for any signs of wear or corrosion. Clean them if necessary with fresh water and a cloth.
   - Inspect the pump for any clogs or debris. Clean it by running fresh water through the system as described in the cleaning process.
7. **Final Check:**
   - Ensure all components are dry and free of pesticide residue.
   - Reassemble the payload system, making sure all connections are secure and there are no leaks.
8. **Storage:**
   - Store the drone in a clean, dry place to prevent any potential damage from moisture or pesticides.

## 5.3. FPV Camera Maintenance

| |
|---|
| Maintenance of FPV cameras performed by users is limited to cleaning and clearing any particle dust or particle deposit on the surface. And It is done monthly |

**Frequency:** Monthly

1. **Clean the Camera Lens:**
   - Use a lint-free clean cloth to wipe the camera lens.
   - Ensure there is no dust or Foreign Object Debris (FOD) settled on the lens.
   - This helps maintain clear vision and prevents obstruction of the camera view.
2. **Check Video Feed:**
   - Verify that the video feed is seamless and clear.
   - Test the transmission over the range of the Unmanned Aerial System (UAS).
   - If any errors are detected (e.g., signal loss, distortion), immediately contact the manufacturer for troubleshooting and potential repairs.


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## 5.4.Terrain Following Radar

| |
|---|
| Maintenance of Terrain Following Radar performed by users is limited to cleaning and clearing any particle dust or particle deposit on the surface. And It is done monthly |

**Frequency:** Monthly and Every 6 Months

**Monthly Maintenance**

1. **Clear Obstructions:**
    - Ensure no other drone components such as tubes or wires obstruct the radar.
    - Check for any physical obstacles that could interfere with the radar's functionality.
2. **Clean the Radar:**
    - Use a clean lint-free cloth to wipe the radar surface.
    - Remove any FOD (dirt, debris) that might have accumulated.
    - This ensures the radar operates effectively without any hindrances.

**Every 6 Months Maintenance**

1. **Inspect Wires and Connectors:**
    - Examine the integrity of all wires and connectors associated with the TFR.
    - Look for any signs of wear, damage, or corrosion.
    - If visual damage is found, contact the manufacturer promptly to arrange for replacement.
    - This proactive inspection helps prevent potential electrical failures or malfunctions during operations.

### Additional Tips

- **Documentation:** Maintain a detailed log of all maintenance activities performed, noting dates, findings, and any actions taken.
- **Manufacturer Contact:** Always reach out to the manufacturer for guidance if you encounter any issues beyond routine maintenance or if you are unsure about specific procedures.


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- **Environment Considerations:** Perform maintenance in a clean, controlled environment to minimize the risk of introducing contaminants or causing accidental damage.

### 5.4.1. Calibration

Calibration is the process of configuring an instrument to provide a result for a sample within an acceptable range. Calibration of sensors (accelerometer, compass), ESC and RC are given in this document under section 8

## 5.5. Mechanical maintenance

### 5.5.1. Inspection

Rotor Frame:

- Check each component extremely carefully and note down the damage to the authorized service center immediately and await further instructions.
- Confirm that all the screws are still adequately tightened.
- Check the aircraft for breaks or damage. If there is any reason to believe that detectable damage might affect flight safety. Replace the part of the airframe.
- Check the carbon tubes of the arms for damage.
- Check whether the arm sleeves are loose or not

Landing gear:

- Check whether there is any deformation on the landing pads of the gear when it is placed at flat surface. If there is any deformation the horizontal landing gear needs to be changed.
- Check whether there is any deformation on the vertical landing gear when it is placed at flat surface. If there is any critical deformation the vertical landing gear needs to be changed.
- Check the dampers on the landing gears. If they are loose, secure them with Loctite.


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- Check the landing gear connectors for scratches or cracks

## 5.6. Replacement

Frame assembly:

- Remove the fixing screws (M3*8) of the top frame, then flight control board mounting plate.
- Turn the frame over and remove the fixing screws (M3*10) of the bottom plate.
- Pass the XT90 power cord through the three-hole protective coil.
- Use M6*8 screws to fix the power cord on the terminals of the power distribution board, paying attention to distinguish the positive and negative poles.
- Customers can choose the left and right sides of the outlet.
- Restore the M3*10 self-tapping screws of the power distribution board cover.

Landing gear installation:

- Put the XT90 fixed seat on the diagonal brace, and then insert it into the tripod fixed seat to reach the bottom.
- The positioning hole of the diagonal brace is flush with the positioning hole of the landing gear mount.
- Fix the limit hole M3*8 screw and the fixing seat M4*12 screw.
- Insert the diagonal brace into the tripod crossbar tee until it reaches the bottom.
- Tighten two M3*10 screws and one M3*20 screw.

Arm installation:

- Put the carbon tube into the folding part and fix it with M6*60 screws + locknut.
- Use the L-shaped allen key for fixing.
- Insert the arm into the body locking buckle.
- Reach the fuselage limit.
- First fix the locking buckle limit M3*8 screw.
- Then fix the locking button M4*20 screws.
- Install 40MM arm pipe clamp.
- Install the pipe clamp fixture.
- Pass the M4*45 screw through the arm pipe clamp.


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- Use an M4 lock nut to fix the reverse side.
- Install the finished picture.

Tank Installation:

- Insert the inlet filter into the designated inlet opening of the tank.
- Ensure that the inlet of the tank faces the front side of the drone.
- Align the tank fixtures with the corresponding points of the tank fixture clamp on the vertical landing gear.
- Secure the tank to the vertical landing gear using M6*45mm screws.
- Tighten the screws with a 4mm Allen key.
- Insert the filter into the outlet of the tank.
- Apply Teflon tape to the threads at the outlet of the tank for a secure seal.
- Place the tank outlet cap onto the outlet.
- Wind Teflon tape around the threads of the L pneumatic connector.
- Connect the L pneumatic connector to the tank outlet.
- Tighten the connector using a 17mm wrench.

Tank Removal for replacement:

- Open the drone canopy.
- Disconnect the Radar cables from the CAN Hub.
- Disconnect the flow sensor cable from the Flight Controller.
- Disconnect the Pump signal cable from the Flight Controller.
- Disconnect the Pump power cable from the PDB.
- Use a 3mm Allen key to remove the Pump and Front, Rear, and Terrain-following Radars mounted on the tank.
- Disconnect the tubes from the Pneumatic connectors.
- Use a 4mm Allen key to remove the M6*45mm screws secured in the tank fixing clamps diagonally.
- Gently take out the tank.


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# 6.Replacement of Components

## 6.1.Electrical and electronic replacement

The following parts need to be replaced with Identical parts and electronically paired:

1. Flight Controller
2. Transmitter
3. Forward Obstacle Avoidance Sensor
4. Backward Obstacle Avoidance Sensor
5. Terrain Detection Sensor
6. GPS

Electronic pairing is done by recording the serial numbers of the associated components on the flight controller and then checking whether they match during Power on Self-Test during every flight

**Replacement Of K++:**

- Open the canopy using 2.5 Allen Key
- Remove the motor wires (ESC wires from the flight controller - “M1, M2, M3, M4, M4, M5, M6")
- Remove the CAN hub plug “CAN1"
- Remove the LED indicator plug “LED"
- Remove the PMU power input from “POW"
- Remove the pump signal input “P1"
- Remove the flow sensor input “K1"
- Remove the GPS input “GPS"
- Remove the RC input “RC"
- Remove the Link cable “LINK"
- After removing all the connected wired from FC
- Remove the FC plate by removing the M3*8 fasteners or bolts


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- Remove the FC (K++) from the FC plate. Then re-place the new FC in the middle part of the FC plate which is marked in it.
- Place the FC plate in the fuselage body positioning with the inserts and use M3*8 (4 bolts)
- Identify the M1,M2,M3,M4,M5,M6. In the ESC input wires written in it and connect the respective wires in the FC from M1-M6
- Connect the CAN hub plug “CAN1"
- Connect the LED indicator plug “LED"
- Connect the PMU power input from “POW"
- Connect the pump signal input “P1"
- Connect the flow sensor input “K1"
- Connect the GPS input “GPS"
- Connect the RC input “RC"
- Connect the Link cable “LINK"

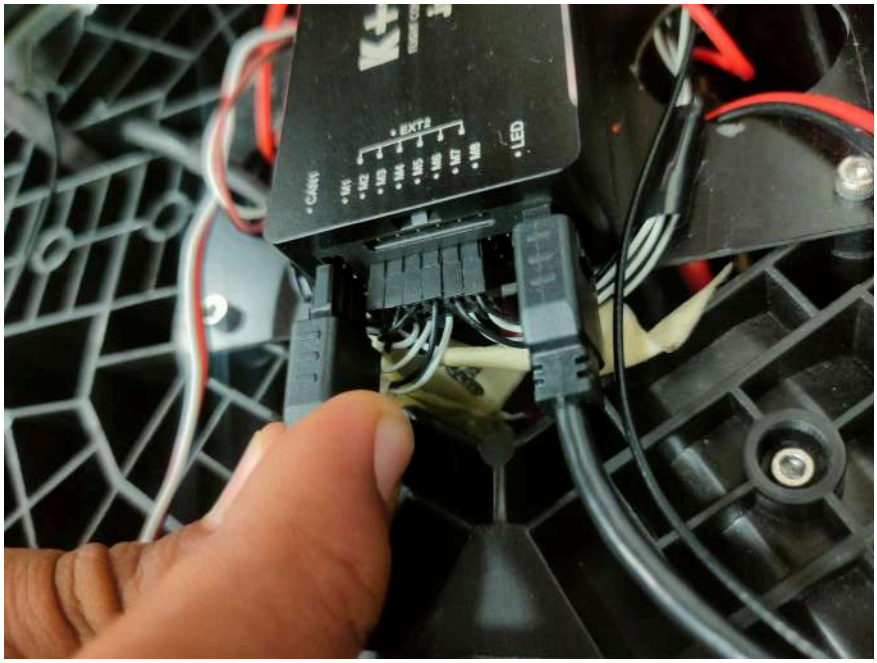


Fig 1.1 : Unplugging the K++ Flight Controller


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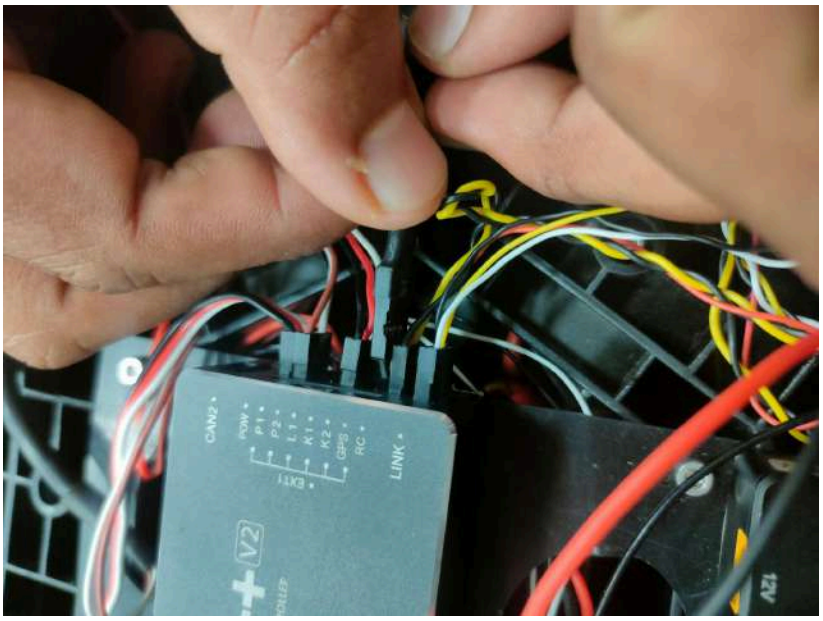


Fig 1.2: Plugging in the K++ Flight Controller RC transmitter

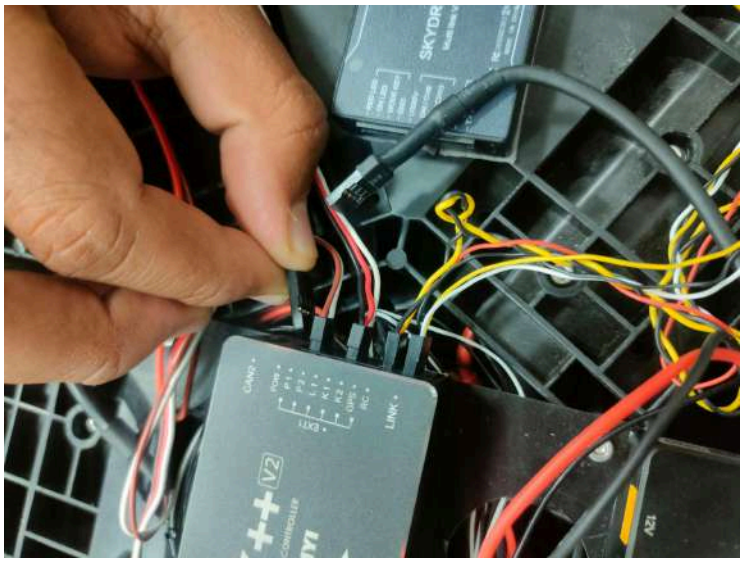


Fig 4.3 : Plugging in the K++ Flight Controller’s power supply

## Replacement Of K++ Gps:


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- First, Battery should be disconnected from the drone.
- Remove the Canopy part with 2.5 Allen key.
- Remove GPS signal wire from GPS Port of the K++.
- Remove the GPS module from the GPS stand.
- Mount the new GPS module on the GPS stand.
- Connect the GPS signal wire to the GPS port of the K++.
- Fix the Canopy part with a 2.5 Allen key.

The sensor binding to the Flight controller is accessed via the Agri Assistant App by the following methodology:

1. Device Manager Option
2. Tool Management
3. Authentication certificate
4. Read
5. Check serial Nos of all sensor and click on Bind


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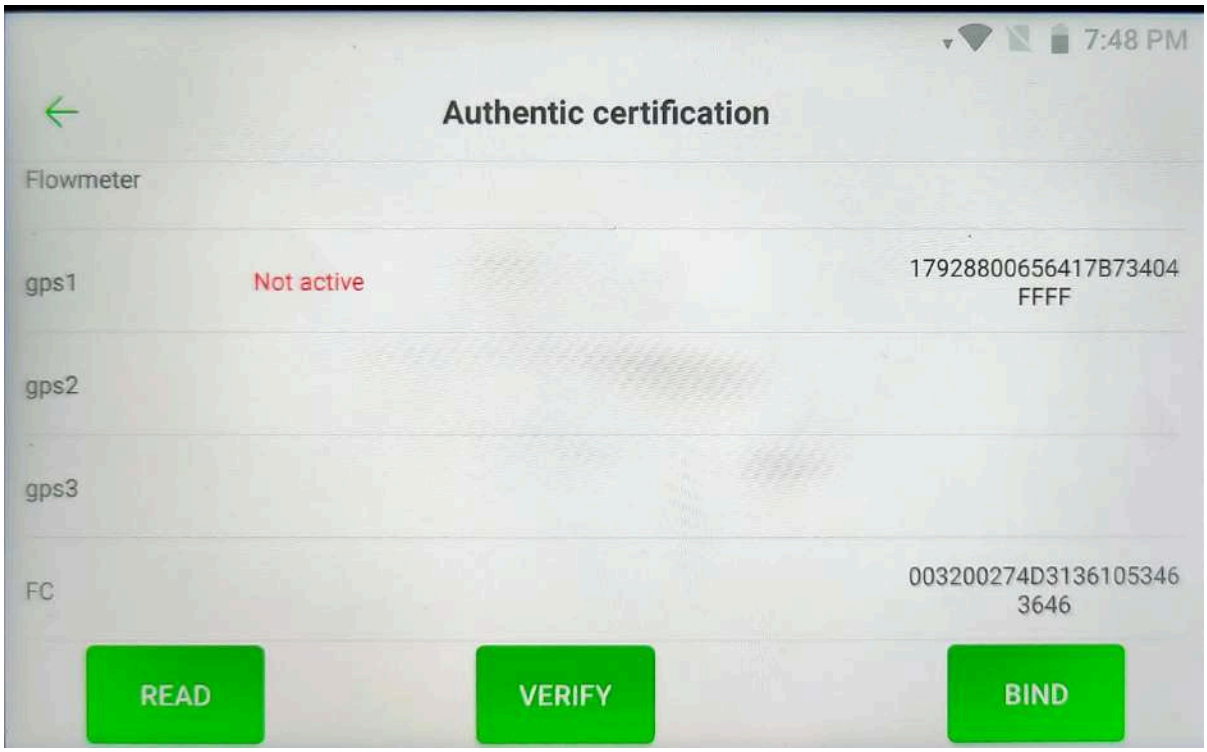


*Fig 15.8 Hardware tamper detection set-up via Agri Assistant*

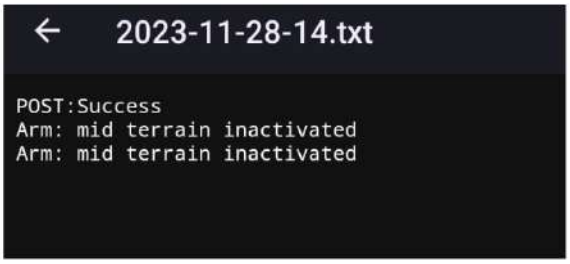


*Fig 15.9 An example of hardware tamper detection*

If there are red “Not active” in any of the items, please contact technical support of Jiyi and provide the corresponding serial number.

Separately, for physical tamper proofing, we have also applied a void tape based mechanism. Void tapes are applied in the following locations


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| Hardware | No of Tapes |
|---|---|
| Flight Controller | 2 |
| GPS | 2 |
| RC Receiver | 2 |
| Canopy | 4 |

Replacement Of Obstacle Avoidance Sensor:

- First, Battery should be disconnected from the drone.
- Remove the Canopy part with 2.5 Allen key.
- Remove the obstacle avoidance cables connected to 12V CAN Port
- Remove the Obstacle Avoidance module from the Obstacle Avoidance mount.
- Mount the new Obstacle Avoidance module on the Obstacle Avoidance mount
- Plus the obstacle avoidance cables connected to 12V CAN Port
- Fix the Canopy part with a 2.5 Allen key.

Replacement Of Receiver:

- First, Battery should be disconnected from the drone.
- Remove the Canopy part with 2.5 Allen key.
- Remove the H12 receiver’s connector from the Receiver.
- Remove the 2 Antennas connected to the receiver.
- Take a new Receiver and connect it to the H12 Receiver’s Connector.
- Take the 2 new Antennas and connect it to the receiver wire carefully without twisting the wires.


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- Fix the Canopy part with a 2.5 Allen key.

The receiver binding to the Flight controller is accessed via the Agri Assistant App by the following methodology:

1. Device Manager Option
2. Tool Management
3. Authentication certificate
4. Read
5. Check serial Nos of all sensor and click on Bind
6. If there are red “Not active” in any of the items, please contact technical support of Jiyi and provide the corresponding serial number.

### 6.1.1. Inspection

- Ensure that there are no obstacles on or around the GPS module or around the antennas on the landing gear. Remove any obstacles (such as tapes with conductive material) that might affect or block the signal.
- Ensure that there is no loose attachment on the receiver antenna. If any loose attachment does not rotate the antenna without holding the back end of the antenna holder.
- If there is any damage on the receiver wire or antenna. Replace the antenna in case the antenna is damaged or Replace wire in case of the receiver damage.
- If the power supply for the drone is fluctuating or it is not there means we need to check from source to end.The source is battery and end is FC. So we will check and replace PDB and In-line wires.
- If the pump is not spraying pesticide properly means we need to check and replace the pump and its inline wiring.
- If calibration failure is happening frequently means we need to check and replace the FC.
- If there is any malfunction in the motor. We need to check and replace the motor.


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- If there is any malfunction in the hardware safety switch. We need to check and replace it.

### 6.1.2. Replacement

Replacement Of Receiver:

- First, Battery should be disconnected from the drone.
- Remove the Canopy part with 2.5 Allen key.
- Remove the H12 receiver's connector from the Receiver.
- Remove the 2 Antennas connected to the receiver.
- Take a new Receiver and connect it to the H12 Receiver's Connector.
- Take the 2 new Antennas and connect it to the receiver wire carefully without twisting the wires.
- Fix the Canopy part with a 2.5 Allen key.

Replacement Of PMU:

- First, Battery should be disconnected from the drone.
- Remove the Canopy part with 2.5 Allen key.
- Remove the PMU module from POW port of the controller.
- Remove the Flight Controller mounting plate using 2.5 Allen key and remove the XT60 connector of PMU from the Power Distribution Board.
- Solder a new XT60 connector with the new PMU module.
- Connect the XT60 connector to the Power Distribution Board and fix the mounting plate using the 2.5 Allen key.
- Connect the PMU to the POW port of the controller.
- Fix the Canopy part with a 2.5 Allen key.

Replacement Of Water Pump:


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- First, Battery should be disconnected from the drone.
- Remove the cowling part with 2.5 Allen key.
- Remove P1– out signal wire of pump from the controller.
- Remove the Flight Controller mounting plate using 2.5 Allen key and remove the XT60 connector of Pump from the Power Distribution Board.
- Solder a new XT60 connector with the new Pump's power cable.
- Connect the XT60 connector of the pump to the Power Distribution Board and fix the mounting plate using the 2.5 Allen key.
- Connect P1 – out signal wire to the controller from Pump.
- Fix the cowling part with a 2.5 Allen key.

Replacement Of Motor:

- First, Battery should be disconnected from the drone.
- Remove the Canopy part with 2.5 Allen key.
- Remove the Flight Controller mounting plate using 2.5 Allen key and remove the XT60 connector of Motor from the Power Distribution Board.
- Remove the Main-out signal wire of the motor from the controller.
- Solder a new XT60 connector with the new motor's power cable
- Connect the XT60 connector of the motor to the Power Distribution Board and fix the mounting plate using 2.5 Allen key.
- Connect Servo Main-out signal wire to the controller from Motor.
- Fix the Canopy part with a 2.5 Allen key.


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*Table 4.2 :Checklist for Hobbywing X6 plus replacement of Motor with an identical one*

| S. No | Name of the Checks | Quality Checkpoints | Equipment used | Measured Value / Remarks | QC 1 Pass |
|---|---|---|---|---|---|
| **1** | Hardware | Check and identify if the product specification names it as Hobbywing X6 plus | | | |
| **2** | Functional Test | Check if the motor rotates in the right direction as the motor that is being replaced | | | |

Replacement Of CAN Hub:

- First, Battery should be disconnected from the drone.
- Remove the Canopy part with 2.5 Allen Key
- Remove the wire from PDB to CAN Hub's 6S-14S port
- Remove the obstacle avoidance cables connected to 12V CAN Port
- Remove the Terrain following cable connected to 12V CAN Port
- Remove the CAN 1 port connected to Flight Controller
- Plug the obstacle avoidance cables connected to 12V CAN Port
- Plug the Terrain following sensor's cable to 12V CAN Port
- Plug the wire to CAN 1 port from FC's CAN 1
- Plug the wire from PDB to CAN Hub's 6S-14S port


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- Tight the Canopy with 2.5 Allen Key




*Fig 4.4 Unplugging the CAN hub's obstacle avoidance sensor cable*

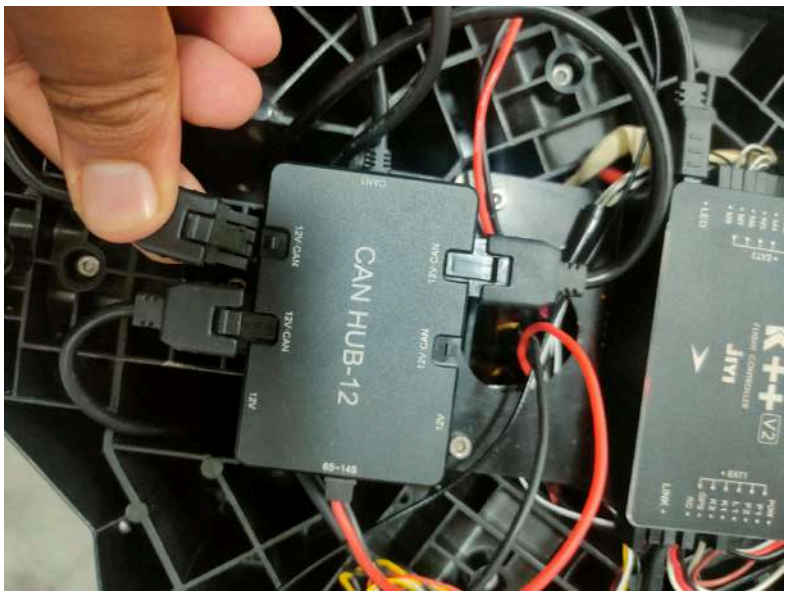


*Fig 4.6 Plugging in the CAN hub's terrain following sensor cable*


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Replacement Of Obstacle Avoidance Sensor:

- First, Battery should be disconnected from the drone.
- Remove the Canopy part with 2.5 Allen key.
- Remove the obstacle avoidance cables connected to 12V CAN Port
- Remove the Obstacle Avoidance module from the Obstacle Avoidance mount.
- Mount the new Obstacle Avoidance module on the Obstacle Avoidance mount
- Plus the obstacle avoidance cables connected to 12V CAN Port
- Fix the Canopy part with a 2.5 Allen key.

## 6.2.Software maintenance

### 6.2.1.Updating

**Need for Firmware Upgradation:**

Firmware upgradation is required because of the following situations:

- To fix the bugs
- To avoid hacks
- Rolling out the new features
- Security improvement
- Interaction with new media
- To prevent the loss of a drone
- Optimize the performance of the device.

**Process of Upgradation**


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The firmware upgrade will overwrite the existing microcode with the new program, which may be incompatible with the model of your device. Agri Assistant provides a manual firmware upgrade.

**The Firmware Upgrade Process**

Firmware upgrades involve overwriting the existing microcode with a new program. Caution is necessary, as installing incorrect firmware may potentially harm your device. K++ provides a manual flight control upgrade option via Agri Assistant APP provided with the transmitter

**Firmware Upgradation:**

1. Connect the flight controller(K++) via parameter connector cable to the transmitter
2. Go to settings
3. Select About
4. Select Security

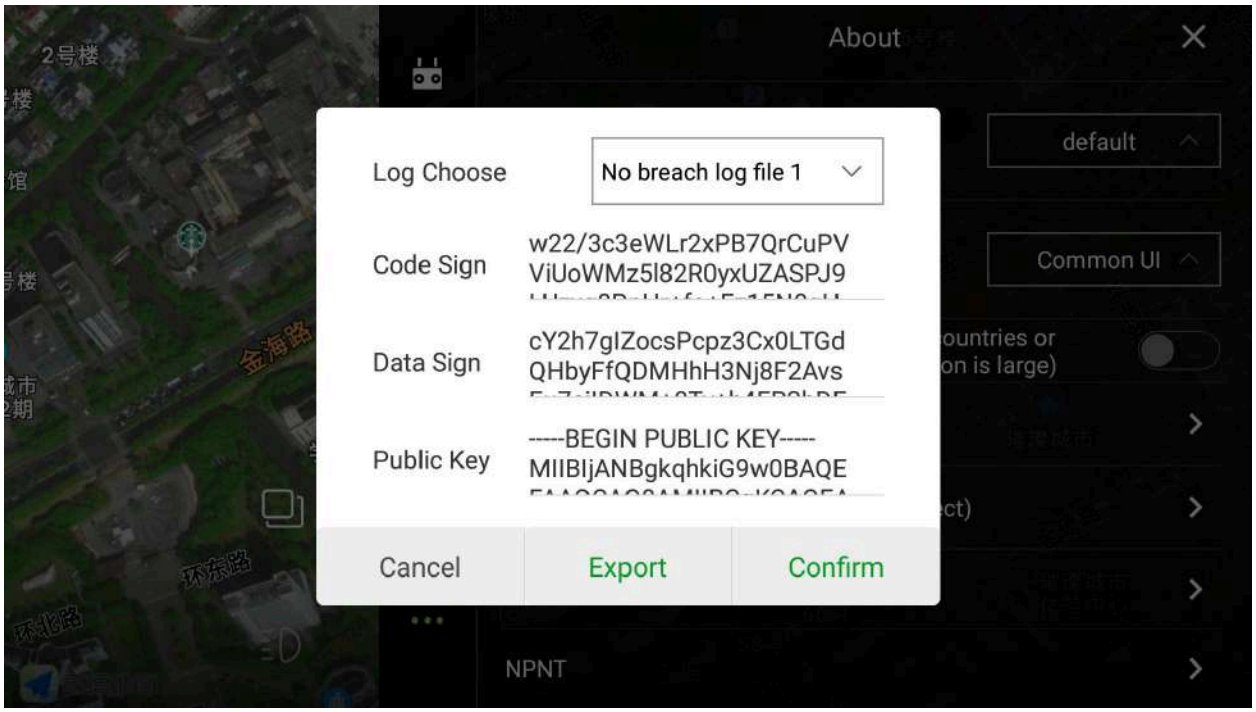


*Fig 4.7 Click on confirm to register the firmware code*

5. Select Device


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6. Firmware Upgrade
7. Click Connect

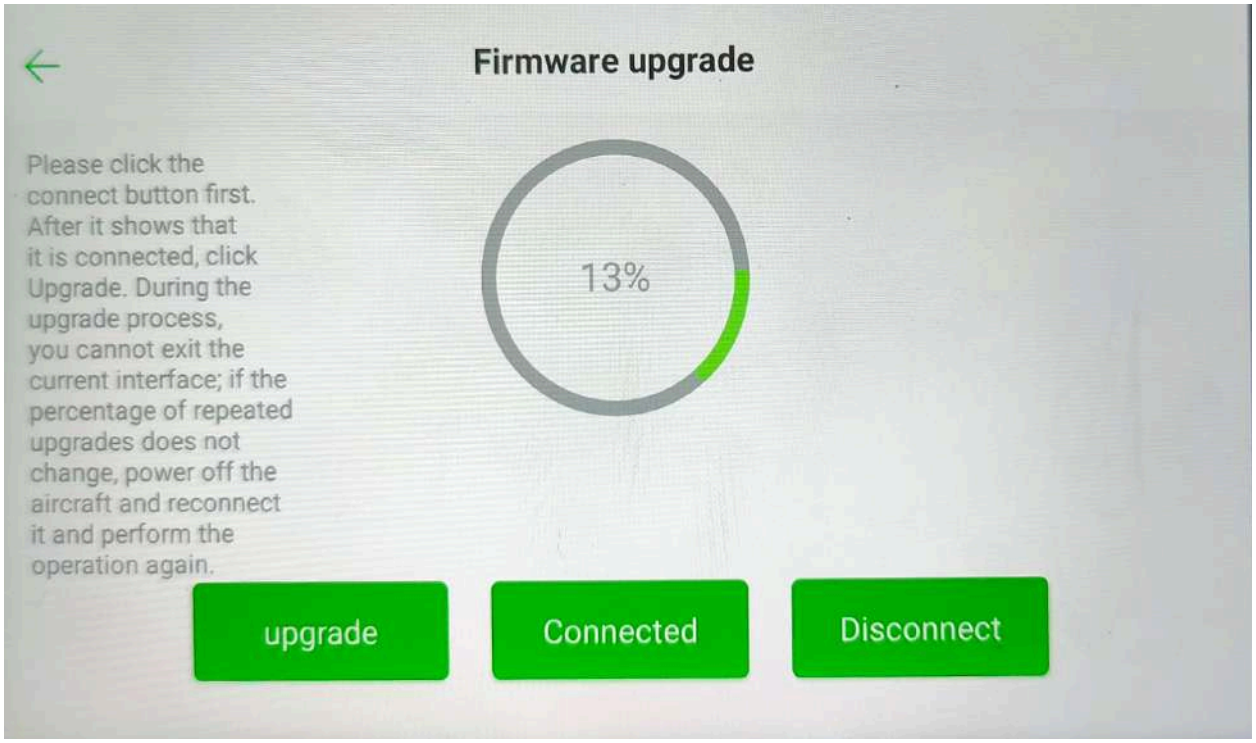


*Fig 4.8 The firmware upgrade in progress on the Agri Assistant APP*

8. Click on Upgrade

If the verification is failed during the security check, the firmware upgrade will fail

Firmware upgrades are a crucial aspect of maintaining your device's performance, security, and functionality. It's vital to follow the upgrade process meticulously to ensure a successful upgrade without any issues.

## 6.3.Troubleshooting:

### 6.3.1.Common issues:

- The compass is not healthy.
- After the compass calibration is done. The UAS will not arm.


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- The vehicle's home position is not visible in GCS.
- There will be lag while uploading a flight plan.
- The Agri Assistant will show bad gps.
- RC2 is not neutral.

### 6.3.2. Solutions:

- The Compass needs to be calibrated on all orientations.
- The issue for compass calibration needs to be removing the battery so that the compass is calibrated and again plugging it in the drone.
- The vehicle home position is necessary before flying. To get the home position of the drone you require to close the app and unplug the battery and again plug it in the drone.
- To prevent bad GPS, the machine should not be under the tree.
- To rectify the RC2 value issue need to check in Agri Assistant whether the RC values are neutral.


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# 7.Inspection and testing:

## 7.1.Inspection procedure

- Clean frame of mud and dirt.
- Inspect frame for cracks.
- Check for any loose screws. If loose, tighten them.
- Check propellers for damage like cracks or deformation.
- Check propellers whether they are free-spinning.
- Check motors for dust, debris and obstructions.
- Check the state of wiring and solder joints.
- Check whether the camera is clean.
- Check whether the landing gear has any deformation or cracks.
- Check whether any error displays in the control station.

## 7.2.Flight Testing procedure

- Check the battery voltage before attaching it ono the drone.
- Turn on the transmitter and plug the battery to the Drone.
- Open the Agri Assistant GCS and connect the software to the transmitter through USB or bluetooth.
- Check the Agri Assistant whether the data are displayed to the pilot.
- Check each value of the displayed data in Agri Assistant GCS.
- Initially arm the drone without a propeller and check all the motors are spinning and disarm the drone using a transmitter.
- **Remove the battery** and then attach the propeller to the motor.


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- Arm the drone and takeoff the flight in altitude mode without payload.
- Switch the flight mode from Altitude to GPS using a transmitter.
- Hover the drone for a few minutes without pilot input given.
- Pilot needs to give all the motion(pitch,roll and yaw) to the drone in low altitude.
- Trigger RTL switch checks whether the drone lands on the home set position.
- Fill the tank with liquid and also check the sprayer system whether the sprayer is working till it is emptied
- In Agri Assistant, Need to map the layout of the area and proceed with the flight test. Refill the liquid again.
- Arm the drone and takeoff the flight in altitude mode with payload.
- Switch the flight mode from Altitude to GPS using a transmitter.
- Trigger the autonomous mode switch to fly the predefined path.
- Switch the mode to altitude or GPS after the flight path is completed and land the drone.
- Unplug the battery from the drone and close the app.
- Turn off the transmitter.

## 7.3.Acceptance criteria

**Warranty Service:**

You can apply for our product warranty service if there is a performance failure during the effective warranty period.

**Replacement Service will not be provided where:**

Service is requested more than 15 calendar days after receiving a product.

- Legal proof-of-purchase, receipts, or invoices are not provided, or are reasonably believed to have been forged or tampered with.


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- A product sent to us for replacement does not include all original accessories, attachments and packaging, or contains items damaged by user error.
- A product is found to have no defects after all appropriate tests are conducted by us.
- Any fault or damage of the product is caused by unauthorised use or modification of the product, including exposure to moisture, entry of foreign bodies (water, oil, sand, etc.) or improper installation or operation.
- Product labels or serial numbers show signs of tampering or alteration.
- Damage is caused by uncontrollable external factors, including fires, floods, high winds, or lightning strikes.
- Received product has not been sent back for 7 calendar days after replacement confirmation from us.
- Proof of damage during transit issued by the carrier cannot be provided.


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# 8.Service and support:

## 8.1.Service centre locations

All the services and advanced maintenance will be done in the

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**Address:** IIT-Madras Thaiyur Campus, Chennai, Tamil Nadu-600113.

## 8.2.Warranty information

The Vihaa Agri drone has a manufacturer defecting based warranty for upto 1000 flight hours or 12 months whichever comes first.

## 8.3.Contact information

Shravan Krishnan

Contact no: 9840382109

Email id: shravan@eplane.ai

# 9.Technical data:

## 9.1.Dimensions and weight

### 9.1.1.Dimensions

| S.NO | **Parameters** | **Values** |
|---|---|---|
| 1 | Motor to motor diameter | 1410 mm |
| 2 | Maximum Diameter (Propeller tip to tip) | 2027mm |
| 3 | Height | 581 mm |
| 4 | Dry Weight | 16.86 Kg |


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| | | |
|---|---|---|
| 5 | MTOW | 29.48 Kg |
| 6 | Empty weight (without battery and payload) | 11.55 Kg |
| 7 | Weight of UAS without battery | 24.15 Kg |
| 8 | Payload weight | 10 Kg |
| 9 | Battery weight | 5.3 Kg |

### 9.1.2.Weight

| | |
|---|---|
| Empty weight (without battery and payload) | 11.5 Kg |
| Weight of UAS without battery | 24.15 Kg |
| Maximum all up weight of UAS | 29.48 Kg |
| Payload weight | 10 Kg |
| Battery weight | 5.3 Kg |

## 9.2.Motor and power specifications

| Motor | Hobbywing X6 plus |
|---|---|
| Max Thrust | 11.8kg/Axis (48V, Sea Level ) |
| Recommended Battery | 12S |
| Recommended Thrust load | 3-5.5kg/motor(48V, Sea Level) |
| Waterproof Rating | IPX6 |
| Operating Temperature | -20°C - 50°C |
| Stator Size | 62mm |


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| | |
|---|---|
| Kv rating | 150 |
| O.D of Carbon Fiber Tube | φ30mm/φ28mm |
| Propeller Diameter | 24 inches |
| Propeller Pitch | 8 |
| ESC | 80A (Hobbywing X6 plus power system) |
| Max. Input Voltage | 61V |
| PWM | 1050-1950μs |
| Max. Input Current (Cont.) | 80A(w/ Good Heat Dissipation ) |
| Product Weight (ESC/Motor/Prop) | 790g |

## 9.3.Battery specifications

| | |
|---|---|
| Brand | Magnipower LLP |
| Capacity(mAh) | 25200 |
| Voltage(V) | 21.6 |
| Discharge Rate(C) | 11 |
| Max Burst Discharge Rate(C) | 15 |
| Configuration | 6S6P |
| Net Weight (±50g) | 2750 |
| Length(± 5 mm) | 214 |
| Width(± 5 mm) | 98 |
| Height(± 5 mm) | 81 |


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| | |
|---|---|
| Connector type | XT90 ANTI SPARK |

## 9.4.Control and communication specifications

| | |
|---|---|
| FC | K++V2 |
| Processor | 32bit STM32H743ZI, 400 MHz<br>1 MB RAM<br>2 MB Flash (fully accessible) |
| Servo outputs | 8 PWM servo outputs (8 from IO) |
| Sensors | Accelerometer: (3) ICM20948, ICM20649, ICM20602<br>Gyroscope: (3) ICM20948, ICM20649, ICM20602<br>Compass: (1) ICM20948<br>Barometric Pressure Sensor: (2) MS5611 |
| Input voltage | 2S - 12S |
| Rated input current | 2.5A |
| Rated input/output power | <5W |
| Dimensions | 72.6 × 48.0 × 22.8 mm |
| Operating Temp | -10C to 55C |
| IP rating/Waterproofing | Not waterproof |
| Servo rail input voltage | 3.3V / 5V |
| USB port input voltage | 4V - 5.7V |
| Transmitter/Receiver | Skydroid H12 |


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| | |
|---|---|
| Weight of transmitter | 540g |
| Weight of receiver | 14g |
| Frequency band | 2.400-2.4833GHz |
| Camera | MINIDCAM (Comes with communication system(5V)) |

## 9.5.Payload specifications

| Components of Payload | Specifications | Quantity/capacity |
|---|---|---|
| Nozzles | High pressure, fan shaped atomization. | 4 |
| Pneumatic connectors | 6x 6 mm coupler | 4 |
| Pneumatic connectors | 6x8 mm T-connector | 2 |
| Pneumatic connectors | 8x12 mm T-connector | 1 |
| Pneumatic connectors | 12x12 mm coupler | 1 |
| Pump | 5liter,<br>Max Voltage : 50.4V | 1 |
| Pneumatic tubes | Radius of 6mm, 8mm & 12mm | 8(4+2+2) |
| water & pesticide mixture | Varies with crop | 10liters |


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## 9.6.Environmental specifications

| | |
|---|---|
| Temperature | -10℃ to 55℃ |
| Relative humidity | 90% ± 5% |


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# 10.Calibration

## 10.1 Calibration Procedure

1. The drone needs to be calculated for the following conditions:
2. It is the drone's first flight.
3. It has been more than a month since you have flown your drone.
4. The compass displays interference warnings after changing the location.
5. If your flying location is more than six miles from the last flight location, then compass calibration is required.

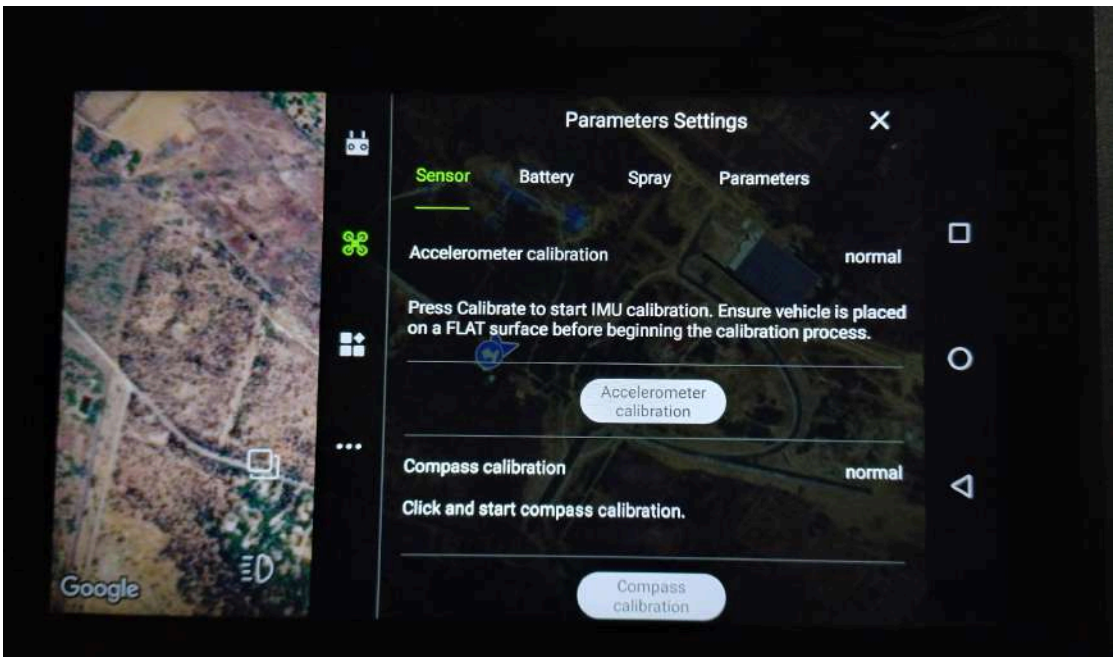


Figure 10.1: Calibration Homepage


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The Sensor section in parameters settings allows you to configure and calibrate the vehicle's compass and accelerometer. For availing better performance from the sensors, one should calibrate these before the flight.

## 10.2 Calibration Of Accelerometer

Under this setting, you can calibrate the accelerometer of the device. Once you click on the ‘Accelerometer Calibration' button you would be asked to hold the vehicle in various orientations. Follow the instructions popped on the screen and calibrate the accelerometer.

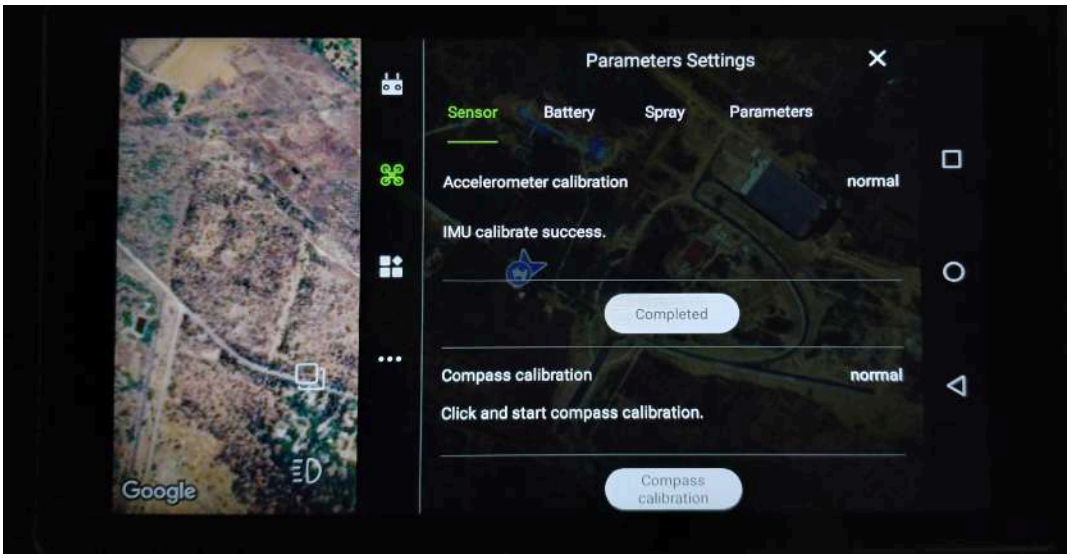


Figure 10.2: Accelerometer Calibration

## 10.3 Calibration Of Compass

Select the "Compass Calibration" tab first. Click on the "Compass Calibration" button. Follow the instructions displayed on the screen. You need to rotate the vehicle randomly around all axes until the progress bar is way to the right and the calibration completes.


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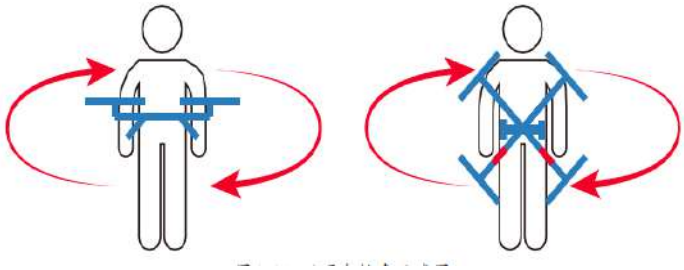

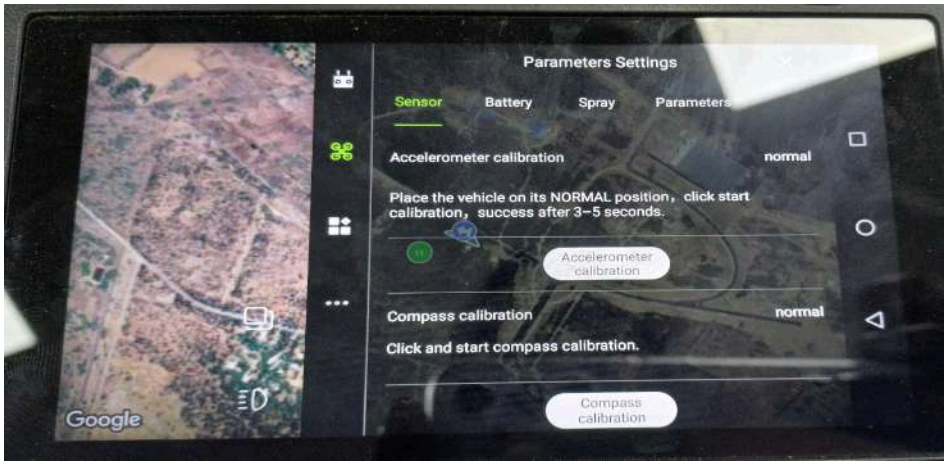


Figure 10.3: Compass calibration.

**NOTE:** While the drone is armed, compass calibration is not possible.

## 10.4 RC Calibration

In RC configuration (RPA Configuration > RC Config), RC transmitters allow the pilot to set the flight mode, control the vehicle's movement and orientation and turn on/off auxiliary functions (i.e. Turning ON & OFF of pump, etc.).

- RC Calibration involves capturing each RC input channel's minimum, maximum and "trim" values so that Agri Assistant can correctly interpret the input.
- Move both sticks in the largest circle possible so that they reach their complete range of motion. Move the other toggle switches through their range of positions.
- Your transmitter should cause the following control changes:
- Channel 1: low = roll left, high = roll right.
- Channel 2: low = pitch forward, high=pitch back.
- Channel 3: low = throttle down (off), high = throttle up.


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- Channel 4: low = yaw left, high = yaw right.

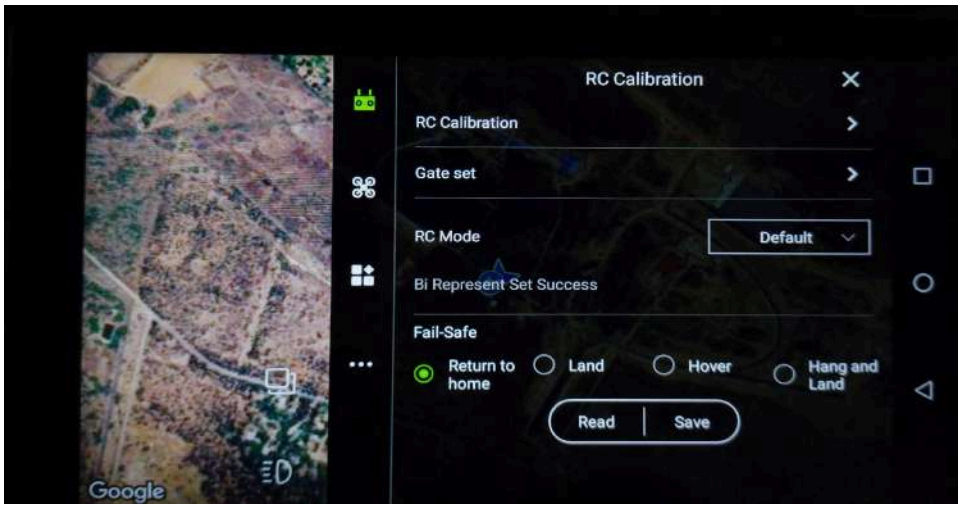


Figure 10.4: RC Calibration Homepage

For calibrating RC through Agri Assistant, click on the "RC Calibration" button. Follow the instructions popped up on the screen.

1. Ensure the status of transmitter and receiver as Power On.
2. Ensure that the transmitter and receiver are connected properly.
3. Ensure that the propellers are not connected to the motors. Also, make sure that the motors are not powered ON.
4. Click ok and move all sticks and switches to their extreme positions.
5. Reset all transmitter trims to centre. Then click the "Ok" button.
6. Click on the "Click When Done" button to move further.
7. Detected RC values will be displayed on the screen.
8. Press the "Ok" button and proceed.
9. You will get the screen as shown in the following image showing that RC calibration is completed.


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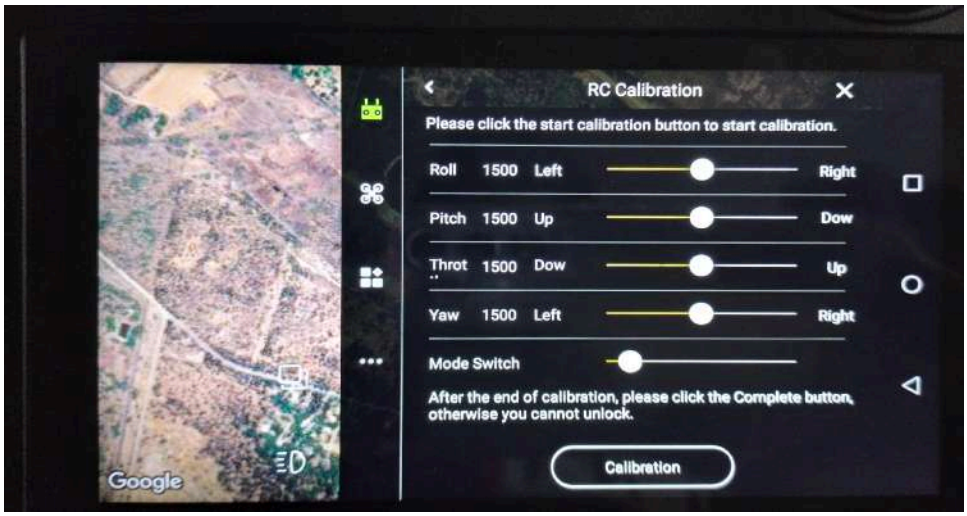


Figure 10.5: RC Calibration

10. Ensure the channels assigned are proper or not. Click on "Save" after confirmation.
11. Parameters are sent to the device. Click on "Ok" to proceed.
12. Now the entire RC calibration process is completed.

## 10.5 Flow Meter Calibration

The flow meter is a device used to measure the flow rate of a liquid in a pipeline. It is designed to be accurate and reliable, making it a valuable tool for various industries such as agriculture, water treatment, and oil and gas.

This calibration updates the flow meter based on the PWM input values that will be supplied by the flight controller. So, the flow meter will measure the liquid flow rate from the pump precisely.


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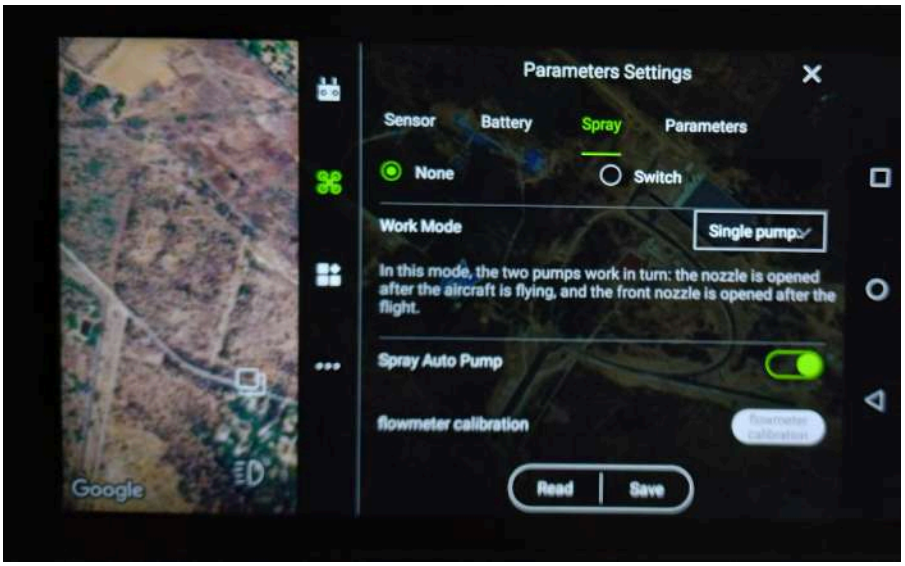


Figure 10.6: Flow Meter Calibration

1. Select the “Spray” tab under the Parameters Settings panel.
2. Click “flow meter calibration” and add the dosage value with respect to the quantity of liquid filled in the tank.
3. Then, click “Start” to begin the calibration.

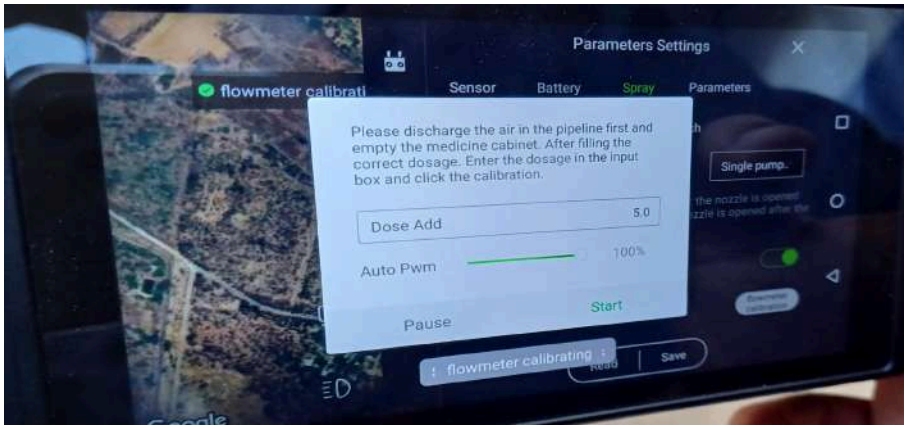


Figure 10.7: Selecting Dosage level for Flow Meter Calibration



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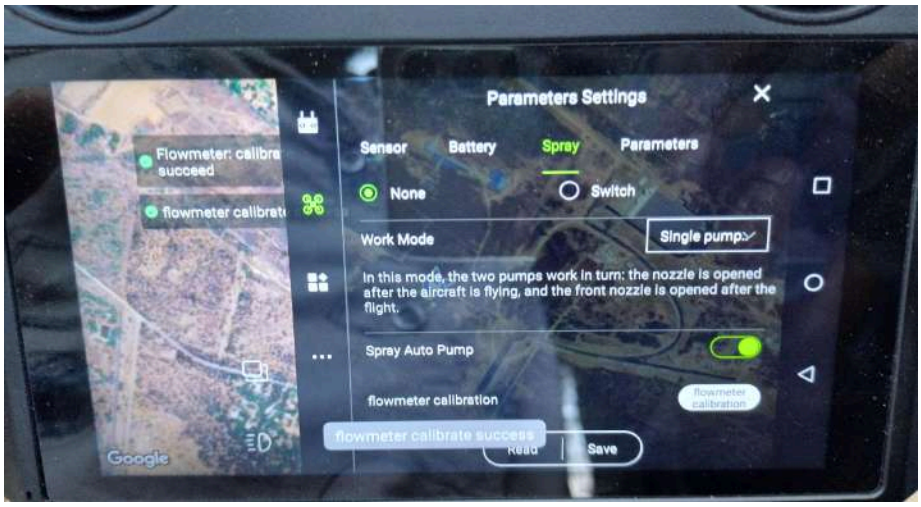


Figure 10.8: Screen Showing Flowmeter calibration Success

# 11.Appendices:

## 11.1.Glossary of terms

| Term | Definition |
|---|---|
| Troubleshoot | trace and correct faults in a mechanical or electronic system |
| Calibration | the process of configuring an instrument to provide a result for a sample within an acceptable range |
| Payload | load carried by a vehicle exclusive of what is necessary for its operation. |


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# ANNEXURES - A

## UAS MAINTENANCE LOG (For Maintenance team)

| | |
|---|---|
| Aircraft name | |
| UIN number | |
| UAV operator | |
| Date of previous maintenance | |
| Total number of flights | |
| Current maintenance date | |
| Location | |

| S. NO | COMPONENT | CHECK | OPERATOR | REMARKS AFTER MAINTENANCE (SAT/UNSAT) | QA NAME & SIGNATURE |
|---|---|---|---|---|---|
| 1 | Frame | Check for deterioration, cracks, & deformation. Replace if required. | | | |
| 2 | Arms | Check for deterioration, cracks, & deformation. Replace if required. | | | |
| 3 | Motors | Replace the motor after 500 flight hours or replace if any | | | |


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| | | | | | |
|---|---|---|---|---|---|
| | | friction occurred. | | | |
| 4 | Propellers | Replace propeller after 500 flight hours or replace if any crack or bend occurred. | | | |
| 5 | Circuit inspection | Check if a high resistance occurred and replace it every six months. | | | |
| 6 | Tank | Replace tank for 1 year based on usage or replace it if any deformation occurs. | | | |
| 7 | Pump | Replace pump after every six months or replace when the flow pressure decreases. | | | |
| 8 | Sensor management | Replace sensor if any error occurred. | | | |
| 9 | Calibration | Calibration needs to be done while inspecting the drone. | | | |



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| | | | | | |
|---|---|---|---|---|---|
| 10 | Landing gear | Replace landing gear after 100 flights. Replace if any crack and bend occurred. | | | |
| 11 | Battery | Replace battery after 300 cycles. | | | |

| MAINTENANCE NOTES |
|---|
| |

Signature of Operator authority

Signature of Maintenance


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# ANNEXURES - B

## Daily Inspection program Checklist (for operators)

| S.NO | Procedure | Check list | Remarks |
|---|---|---|---|
| Pre-flight inspection and maintenance procedure | | | |
| 1 | Verify that all arms are securely attached to the centre frame and that the Arm waterproof rings are locked in place. | | |
| 2 | Check for any motion between the locking cap of the arm and the folding mechanism. | | |
| 3 | Inspect the centre airframe for structural anomalies and loose or missing parts. | | |
| 4 | Check for any motion between each motor mount and boom, and between the motor bell and base. | | |
| 5 | Spin the motors by hand to check for smooth rotation and inspect the motor bells for any dents or scratches. | | |
| 6 | Inspect the propellers for correct attachment to the hub with respect to the rotation of the motor,e.g, (CW Propeller- | | |


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| | | | |
|---|---|---|---|
| | to- CW motor), pitch play and wear. | | |
| 7 | Verify that the propellers are clear of surrounding structures and other propellers as they rotate through their full range of motion | | |
| 8 | Test and log the voltage of each battery pack and inspect the batteries for signs of damage or swelling. | | |
| 9 | Inspect the battery connectors and leads for wear or damage and ensure all batteries are securely attached to the battery tray. | | |
| 10 | Verify that the battery plate is securely attached to the airframe and that the landing gear is correctly oriented and attached to the airframe. | | |
| 11 | Check that the GPS and control link antennas are securely fastened and correctly oriented. | | |
| 12 | Verify that the RPA indication lights on the end of each boom are functioning properly. | | |


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| | | | |
|---|---|---|---|
| 13 | Inspect the payload attachment points and ensure that clamps are in place, if used. | | |
| 14 | Check the payload level | | |
| 15 | Verify that all antennas are in good condition and correctly oriented | | |
| 16 | Inspect the control sticks of the transmitter for free movement and check for dust or debris | | |
| | | | |
| **Post-flight inspection and maintenance procedure** | | | |
| 1 | Clean frame of mud and dirt. | | |
| 2 | Inspect frame for cracks. | | |
| 3 | Check for any loose screws. If loose, tighten them. | | |
| 4 | Check propellers for damage like cracks or deformation. | | |
| 5 | Ensure propellers are spinning freely | | |
| 6 | Check motors for dust, debris and obstructions. | | |
| 7 | Check the state of wiring and solder joints. | | |
| 8 | Check whether the camera is clean. | | |


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| | | | |
|---|---|---|---|
| 9 | Check whether the landing gear has any deformation or cracks. | | |
| 10 | Inspect antennae. | | |
| 11 | Check whether any error displays in the control station. | | |
| 12 | Ensure there are no cracks on the rotor frame | | |
| 13 | Check for no thermal deformation on the circuit boards | | |


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# ANNEXURES - C

## Component Monitoring System

| **UAS Model:** | VIHA | **Manufacturer's Name** | UBIFLY TECHNOLOGIES PVT. LTD. |
|---|---|---|---|
| **UIN Number:** | | | |

| S.I No | Part No. | Part Name | Date of Removal | Component hours at Removal | Reason for removal | Root Cause for Removal | Corrective Measure suggested | Corrective Measure implemented | Additional Remarks | Autho -rized Sign |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | | | |
| 2 | | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | | | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |
| 10 | | | | | | | | | | |
| 11 | | | | | | | | | | |



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## List of Critical Components and their maintenance cycles

| | DESCRIPTION | CHECK | Life of Component |
|---|---|---|---|
| 1 | Frame | Check for deterioration, cracks, & deformation. Replace if required. | 2500 flight hours |
| 2 | Arms | Check for deterioration, cracks, & deformation. | 2500 flight hours |
| 3 | Motors | Check for friction and free movement. | 500 Flight hours |
| 4 | Propellers | Replace propeller after 500 flight hours or replace if any crack or bend occurred. | 500 flight hours |
| 5 | Tank | Check for leaks and corrosion, cracks or scratches on the tank | 1 year |
| 6 | Pump | Check for flow pressure | 500 operational hours |
| 7 | Landing gear | Check for any cracks, damage, loose fasteners, or signs of wear like deformation, bending | 3000 landings |


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| | | | |
|---|---|---|---|
| 8 | Battery | Check for any bulges, leaks, Corrosion | Replace battery after 300 Charge Discharge Cycles |
| 9 | Landing gear connectors | Check for any cracks, damage, loose fasteners, or signs of wear like deformation, bending | To be discarded with the landing gear after completion of 3000 landing cycles. |
| 10 | Arm Sleeves | Check for any cracks, damage, loose fasteners, or signs of wear like deformation, bending | To be discarded with the Airframe after completion of 2500 flight hours |
| 11 | T-joint connector | Check for any cracks, damage, or signs of wear like deformation, bending | To be discarded with the landing gear after completion of 3000 landing cycles. |

***Note:*** *Critical components of Arm Sleeve, landing gear connector, and T-Joint connectors will be disposed of along with the airframe and landing gear respectively. These components are integral to the overall structure and functionality of the airframe, and therefore, cannot be reused once the airframe reaches its end of life. All parts together constitute a unified frame, ensuring safety and performance standards are maintained.*


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