STRIEKAIR

Operations- and Maintenance Manual

*CARRY**AIR** HYBRID*

© Striekair engineering GmbH

1 Registration data

This flight and operations manual belongs to the aircraft:

Type	VTOL UAV
Model	*Carry*Air - Hybrid
Built year	_____
Serial Number.	_____

Producer: Striekair engineering GmbH

Owner: _____

_____

_____

This manual must always be kept up-to-date and carried with the aircraft.

document no.:	BHB-002
revision level:	B

2 Change status

You will find the revision status in the footer of every page of this manual. Current pages are to be inserted as soon as available. Invalid pages must be removed. This flight manual must be updated regularly.

Rev.	Reason for change	Date	Name
1.0	first edition	03.2021	T. Strieker
1.1	Takeoff / hover with Tailwind / RC control	04.2021	T. Strieker
1.2	graphs; flight planning Airspeeds	01.06.2021	T.Strieker M.Menze
1.3	Flight in mountainous terrain Checklist Emergency procedures Flight planning Hazard notice Min. states of charge of battery	15.11.2021	T.Strieker
1.4	Chekcklists for mission planning Survey mission in Hover mode	13.06.2022	T.Strieker

1.5	Maintenance Table	20.06.2022	T.Strieker
1.5.1	Flight Altitude	24.10.2022	T. Strieker
1.6	Range Extender Flight time Wiring Range Extender Carbon Front Propeller Screw Torque PA lower	12.12.2022	T.Strieker
1.7	Screw Torque Prop higher	30.05.2023	T.Strieker
1.7	Compass Setup VTOl Approach	10.06.2023	T.Strieker
1.7	Addition of hybrid version	28.09.2025	T.Strieker F. Askari
1.7	Insert Precharge Resistor / Motorstop during transition/ Use Choke in cold weather/ Fire extinguisher needed/ Min Battery Voltage in Flight	03.11.2025	T.Strieker
1.8	Battery Temperatures / Voltage Limits	15.03.2026	T.Strieker

2.1 Content

3 Preliminaries

The CarryAir unmanned aerial vehicle (UAV) belongs to the category of aircraft with a maximum take-off weight of up to 25 kilograms and a wingspan of up to 3 meters. Operation is permitted only by pilots possessing a valid permit or an international license recognized for such activities. For flying the aircraft at higher MTOM up to 30 kg with more fuel the climb performance in hover is the limiting factor.

Within Germany, the UAV may be operated exclusively with an approved flight mission or in designated areas for which an ascent permit has been issued. When operating the aircraft outside Germany, all applicable national laws, regulations, and directives must be strictly observed.

Prior to any flight, it is essential for each pilot to become thoroughly acquainted with the specific characteristics of the aircraft and to receive instruction from an authorized individual.

The selection of the flight path, particularly during take-off and landing, must always allow for a safe landing at any time should circumstances require it.

Unauthorized modifications to the controls, firmware, parameters, airframe, supporting structures, or aerodynamic surfaces are strictly prohibited.
Any technical malfunctions or significant defects must be promptly reported to the manufacturer.

The operator is responsible for ensuring that the aircraft remains compliant with all technical bulletins and manufacturer's instructions. The operational limitations and maintenance requirements set forth in the flight and operating manuals are mandatory and must be always adhered to.
It is the pilot's duty to consult the most current versions of all manuals and operational guidelines prior to flight.
All flights, as well as any alterations to the aircraft, are to be meticulously documented in a logbook.
Furthermore, appropriate insurance coverage for the aircraft must be obtained and maintained.

Hazard Warnings

Please note:

The product is to be operated exclusively in compliance with all relevant laws and regulations of the country or place of use.

This product is not a hobby model but is intended for commercial use and must only be operated by a responsible adult or authorised pilot within visual line of sight (VLOS) and proper safety distances.

Never armed or active the vehicle; remove all propellers before any maintenance. Rotors can cause serious injuries.

Operators must follow all manufacturer instructions and flight handbook requirements, especially regarding battery safety. Always comply with local laws and regulations.

4 System description

4.1 Producer

Striekair engineering GmbH

Marienstraße 18

33332 Gütersloh

4.2 Certification

Unmanned aviation systems with a maximum take-off mass of 25 kg and a wingspan below 3 m.

4.3 Description

CarryAir is a Blended Wing Body aircraft equipped with six hover motors a 2 stroke combustion engine and a Sycamore 160 (Electric Ducted Fan, EDF) for forward flight.

Carryair features a full composite honeycomb sandwich structure.

All electronics onboard are rated for a High Voltage 12S battery system. All the motors and avionics are powered by this central battery. Battery cells require careful monitoring during both discharge and charging cycles, with balancing performed solely during external re-charging.

The flight controller utilised is the Cube, in conjunction with the Skydroid digital video transmission, data transmission, and telemetry transmitter. For further details, please refer to the relevant remote control operating instructions.

Redundant power for the flight controller is provided by two Battery Elimination Circuits (BECs), ensuring reliability. All other onboard electronics—including the Skydroid telemetry system, servos, and position lights—are each supplied by their own dedicated BEC to guarantee stable voltage and independent operation.

The hover motors use hexacopter mode, allowing flight stabilization even if one drive fails. In such cases, landing is still possible, though climbing in hover mode is not. The aircraft can descend at a controlled rate based on its load and remain steerable.

The forward flight is powered by two Sycamore 160 engines from Greenjets Ltd. These high-performance, compact engines are specifically designed for fixed-wing UAVs under 25kg. Each engine delivers 5kg of thrust. The Sycamore 160 provides exceptional efficiency, incorporates safety-focused design principles, and significantly reduces operational noise within the industry.

5 Technical Data

5.1 Airframe Type

Type ……..…….Vertical Take-off and landing - VTOL

Aircraft Design …….....Blended wing body - BWB

Payload ……...Max. 7 kg (inc. 6kg battery)

MTOM ……...…….24.9kg

Empty weight incl. Fuel System and Batteries but without Fuel and Payload...≈19,1kg

5.2 Overall Dimensions

Wingspan ……..….2955mm

Overall longitudinal length ……..……..1500mm

Max fuselage width 800mm

Wing area ……..……..……2m^2

Fig.1: Three view drawing

6 Propulsion

6.1 Hover Motors

T-Motor's P series brushless motors are built for professional agricultural multi-copters and are rated for 1000 hours of operation, according to the manufacturer.

6.2 Hover Propellers

6.2.1 Standard Propeller

Producer ……T-Motor
Type ……..UAV Folding Propeller
Diameter ……22.2”
Pitch ……7.2“
Operation condition ……up to 2000 ft Density Altitude

6.2.2 High performance Propeller

Producer ……Striekair
Type ……Carbon Folding Propeller
Diameter ……24.5”
Pitch ……9“
Operation condition ……up to 9000 ft Density Altitude

For higher altitudes (0–9000 feet), contact us about our high-performance propellers.

6.3 Cruise flight

6.3.1 Sycamore 160

Producer ……..….Greenjets Ltd

Type ……..…….……..…Sycamore 160-5

Fan Diameter ……..……6.3”/160mm

Operation condition ……..…up to 9000 ft Density Altitude

6.3.2 ZG 45SL

Producer ……..….Zenoah

Type ……..…….…….. Two Stroke

Propeller ……..……22”x10”

Operation condition ……..…up to 9000 ft Density Altitude

7 Batteries

All batteries must be handled with care and monitored after charging or discharging.

7.1 Battery charging/Discharge

7.1.1 LiHV – Carryair

Max. Voltage/Cell ……..….4.45V

Max. Charge/Discharge rate ……..…5/60C

7.2 Battery operation in flight

- In flight the LiHV batteries are charged by the generator. If the generator stops charging the battery during flight, you should head for the nearest landing site immediately. In flight the Voltage has to be above 46V during cruise flight to provide enough energy to the Vertical landing. In hover flight, voltage may momentarily drop below 43V due to maneuvers or wind.
- Start the aircraft always with a fully charged and balanced batteries
- **General Information**
- If handled improperly, lithium polymer batteries can explode, burn and release toxic gases as well as cause burns or poisoning. Since we cannot control the proper and correct handling post delivery, we reject any liability for damage and consequential damage of any kind.
- 1. ALWAYS store and charge any battery in the aircraft outside of an enclosed space or in a fireproof container which, if ignited, will never spread the fire. Use the battery only for the CarryAir. Always store the battery in a dry and dark place in a cool environment. Never expose it to direct sunlight or excessive heat. Keep the battery away from children and unauthorized persons.
- 2. It is **IMPERATIVE** to observe the information on the number of cells and the discharge and charge currents printed on the respective battery. The number

of cells must be placed correctly into the charger. The charging and discharging currents must not be exceeded under any circumstances.

- 3. **ONLY** use the associated chargers that are suitable for charging lithium polymer batteries. Be sure to use the correct charger. Set the number of cells as well as the charging current and the cut-off voltage on the charger **ABSOLUTELY CORRECT**. To do this, it is **ESSENTIAL** to read and follow the instructions for your charger.

Batteries should not be left unused for extended periods of time, either in the aircraft or in storage. If the battery is not used for long period, it must be fully charged at least once every three (3) months to prolong its life and maintain its performance.

Take note the following precautions:

Routinely check the battery's charge status. Carefully monitor batteries that are approaching the end of their estimated life.

Before every Flight the Batteries must have a Temperature between <u>25 and 35</u> °C to be able to provide the full power at Vertical Take Off!

Typical behavior depending on **Temperature**

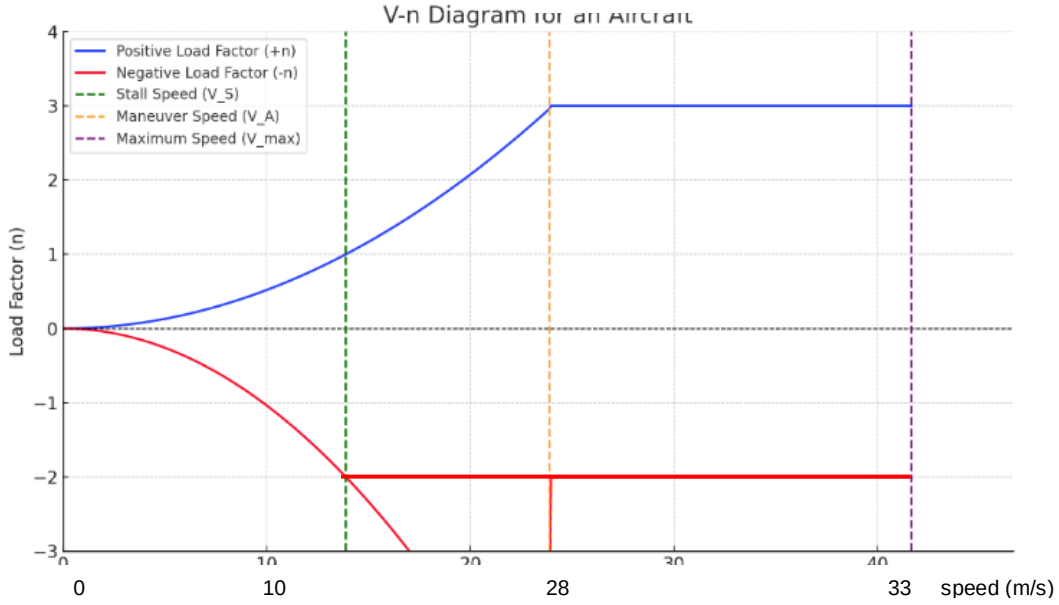
Temperature	Behavior
< 15 °C	High internal resistance → strong voltage drop ❄
20–30 °C	Normal performance
35–45 °C	Maximum power output
> 50 °C	Performance still high, but aging increases significantly
> 60 °C	Critical / damage possible

8 Operating limits

8.1 Flight speeds

Tabelle 1 Flight speeds

Design.	Speed	IAS [km/h]
V_{NE}	speed limit	120
V_{Max}	Maximum speed	120
V_{fbwmin}	Min speed in fly by wire	70
V_{fbwmax}	Max speed in fly by wire (Maneuver speed V_A)	100
$V_{Hovergust}$	Maximum gust wind speed in the hover	40
V_{gust}	Maximum gust wind speed in flight	50



8.2 Operation Conditions

Max fixed wing flight	12,000 feet density altitude	For higher operations, consult the manufacturer
Hover flight	9,000 feet density altitude	For higher operations, consult the manufacturer
Precipitation	<1mm / hour	Flying through clouds is prohibited due to icing conditions
Aircraft operation temperature range	-10°C to +45°C	
Load factors	+3g / -2g	Maximum tested limit load

Battery temperatures must stay within allowed limits. Preheat batteries to 25°C at low temperatures.

Below 10°C, close the front bulkhead hole to stop fresh air entering the cargo area.

Do not foil or paint the aircraft's upper side darker than white.

Attention:

Do not cover the gap from fuselage to the wings with tape. The gap is part of the cooling system and the static pressure port.

The operation of this petrol-powered aircraft requires a CO2 fire extinguisher to be kept near the launch site.

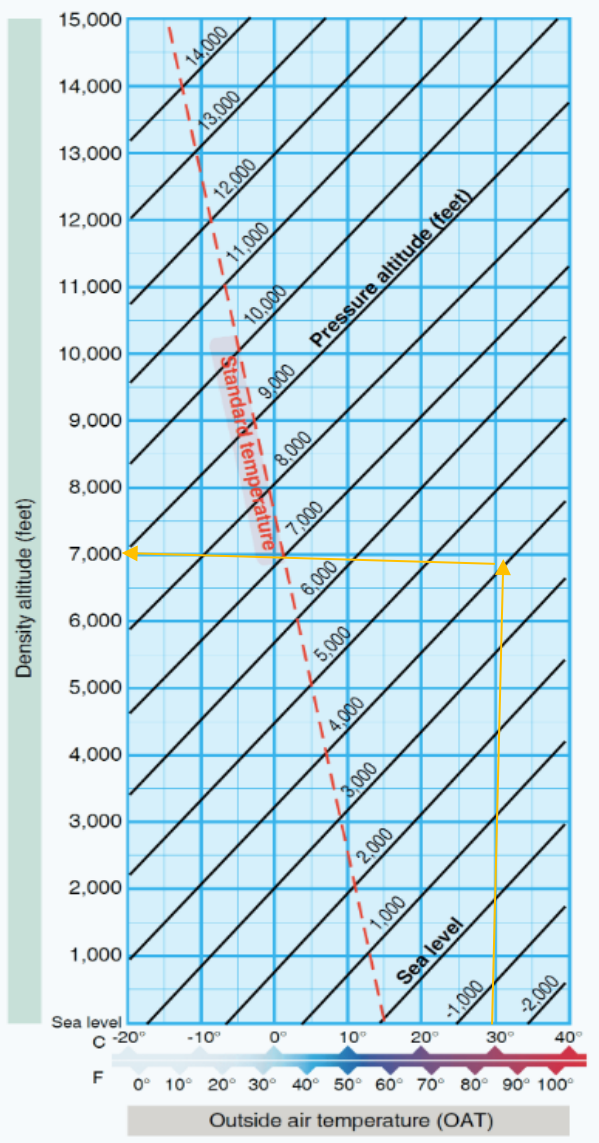
LiHv batteries must only be inserted outside of buildings.

For operation inside buildings, we recommend a power supply unit limited to a current of 3A.

1. Determine the intersection of current temperature and pressure altitude (see yellow sample)

Difference in (ft)	Air pressure at sea level (hPa)
1237	968
1100	973
964	978
827	983
690	988
554	993
417	998
280	1003
144	1008
0	1013
-130	1018
-267	1023
-403	1028
-540	1033
-677	1038
-813	1043
-950	1048
-1087	1053
-1223	1058

2. Add difference based on the air pressure at sea level to take off altitude to get the pressure altitude



8.3 Permitted areas of application / restrictions

- Flights must remain VLOS unless a SORA has been approved.
- In mountain areas, consider:
    - Can the aircraft maintain a 5 m/s climb rate along the slope? How could downdrafts affect this?
    - What are the wind conditions at higher altitudes?
    - Do not transition toward mountains that exceed the 100m hover height; move parallel to or into the valley, depending on wind.
    - Gusts and vortices may hinder climb performance—if the aircraft cannot ascend for an extended time, abort the flight.

8.3.1 Forbidden flight conditions / maneuvers

- Aerobatics
- Spins
- Curves exceeding a 60° inclined position (currently limited to +/- 45° by flight attitude control)
- Flights in icing conditions
- **Flight operations should be discontinued when gusty winds exceed 40 km/h during hovering or 50 km/h during forward flying.**

8.3.2 Stall speed

Operate the aircraft within a safe speed range. If speed falls below minimum, the hover motors engage automatically. Incorrect speed readings may cause loss of control; in such cases, manually activate Q_Loiter or Q_Hover mode.

At full take-off mass, maintain speeds above 70 km/h. In Fly By Wire B mode, flight speed should stay between 70 and 90 km/h.

Stall speeds are dependent on the aircraft's take-off mass. The specified speeds are applicable to straight and level flight; stall speed will increase during turning maneuvers.

9 Flight Operations

9.1 VTOL Approach / Weather Vaning

With CarryAir's firmware, the system automatically detects wind conditions both at startup and during flight to determine the optimal landing direction. Following take-off in hover mode, the aircraft will yaw to align itself into the wind.

9.2 The VTOL approach proceeds as follows:

The aircraft is commanded to return to launch (RTL) at an altitude of 100m above the take-off point. When the aircraft is 200 meters from the designated takeoff/landing position, it begins a circular holding pattern with a radius of 200 meters around the landing site while descending to 50 meters altitude. Subsequently, it adjusts its heading based on the apparent wind and begins an automated QRTL landing procedure until touchdown is complete.

Important considerations:

As the aircraft returns at 100m above the launch point, no terrain features or obstacles within this area may exceed 80 meters above the GPS lock elevation. Additionally, the terrain within a 250-meter radius of the take-off point must not surpass 30 meters in height.

If an overshoot occurs during the Back transition phase, the nose of the aircraft will be reoriented into the wind, after which it will hover and return to the GPS lock position.

9.3 Selection of the airfield

Choosing the right airfield is essential for VTOL safety. Keep the aircraft's view clear of trees, mountains, or other obstacles in both wind-dependent directions during transition phases. If the take-off site is sheltered, check wind direction at flight altitude via a weather app or service. Avoid flying when gusts exceed the aircraft's limits. The launch area should be level, solid, free of debris and holes. If using a tarpaulin, make sure it is securely fastened, heavy enough, and lies flat to prevent contact with the propellers.

9.4 Remote control

Control features long-range HD video transmission and a preset controller system for easy flight mode selection. Check key assignments before every flight.

Swich Number	Flight mode	Description
1	QHover	Flight axes must be controlled sensitively across all axes. The maximum actual and rate of climb is 2 m/s). Caution: Never move backwards into the wind. Nose into the wind and nose in the direction off light!
2	QLoiter	GPS Position Hold Changes to the control stick change the GPS coordinates. Max. rate of climb and incline 3 m/s Max. Airspeed over ground 4 m/s
3	RTL	Return to Launch, Automated return of the aircraft until the landing is completed. Check VTOL approach height of 50m on a circle radius of 200m .
4	Auto	Autonomous Flight, Automated flight operations in which a mission created in advance and uploaded to the cube is flown.
5	Loiter	Auto flight, Circles around the activated point within a selectable radius on the flywiew of the GCS.
6	FBWB	Fly By Wire B, Flight operation in which the control sticks set a rate of descent and climb of max. 4 m/s as well as an incline +/-45° at full deflection and a speed of the aircraft between 70 and 100 km/h.

9.5 Pre-flight check

Before every flight, the pilot-in-command must perform a thorough pre-flight check to ensure safety. This process helps identify and address any damages, defects, or wear early.

9.5.1 External control of the UAV

9.5.1.1Drives:

- Inspect the front engine propeller for any damage and confirm that the spinner is securely fitted. - Observe for potential grinding marks on the motors, as these may indicate issues with engine mountings or improper fastening.
- Manually check the engine mountings and hover propeller blades for looseness or cracks.

9.5.1.2Landing skids

- Ensure that all components are securely in place.
- Inspect for any signs of deformation or cracks.

9.5.1.3Left and right wing:

- Manually inspect the wing and elevons for any loss or cracks.
- Ensure all elevon and rudder connections and linkages are secure.
- Examine the condition of the wing and elevons, checking for holes, cracks, or similar defects.
- Assess hinges and lever arms used in elevon connections and linkages for proper integrity.

9.5.1.4Fuselage

- Inspect surface for cracks, holes, or damage
- Check payloads cover hinges and locks
- Ensure pitot tubes are clean, secure, and unobstructed

10 Carry out a pre-flight inspection

Checklist before take off

PRE-FLIGHT CHECK					
TRANSMITTER	ON AND QGC IS STARTED				
WING BOLTS SECURED	COMPLETED				
AIRCRAFT CENTER OF GRAVITY	AIR BUBBLE INSIDE SPIRIT LEVEL				
ELEVON CONTROL SURFACES	STIFF AND WITHOUT PLAY				
PROPELLER	FOLD OPEN				
MOTOR MOUNTINGS	CHECK FOR TIGHT SIT				
HOVER BATTERIES	CHARGED				
TRANSMITTER	CHARGED				
PLANE POSITIONING	NOSE TOWARDS WIND				
PRECHARGE RESISTOR	PLUG IN				
BATTERIES	PLUGGED IN MAIN BATTERIES				
TRANSMITTER AND NOTEBOOK	COMPASS ALIGNMENT CHECKED				
TRANSMITTER AND NOTEBOOK	ROLL / TILT MOVEMENTS ARE CHECKED				
COVERS / DOORS	CLOSED AND LOCKED				
PILOT TUBE	AIRSPEED TESTED (BLOW IN TUBE)				

11 Flight Procedures

1. Align the aircraft nose into the wind.
2. Set controls to neutral.
3. Go the Manual mode and arm the aircraft
4. Hold down the throttle stick
5. Ignition on
6. (In Cold weather below 15 °C close Choke for the first two start procedures and open the throttle by the stick by 10 to 20 %).
7. Hold the start – until engine power on.
8. Repeat this procedure / the engine must accept the throttle response
9. Switch to QLoiter mode.
10. Once airspace is clear, gradually push throttle forward to reach max climb rate.
11. Climb at 3 m/s for 20–30 seconds to reach 50m, then set throttle to mid-position.

    If the aircraft does not climb for more than 10 seconds, land and check:

    11.1. Propellers function
    11.2. CG and max take-off weight
    11.3. Battery charge
    11.4. Wind direction and speed (including altitude)
    11.5. Battery temperature (minimum 18°C)
12. Switch from Q Loiter Mode to Fly By Wire (FBWB)

    If the combustion engine stops during transition and if the acceleration only by the fan is very slow switch to Qloiter and land the aircraft.

    12.1. Check Fuel Level
    12.2. Restart the engine again on the ground and check the throttle response
    12.3. Open the choke completely
13. In FBFB mode, the throttle lever functions as an airspeed selector. Positioning the throttle at the midpoint corresponds to a flight speed of approximately 85 km/h. The hover motors are engaged automatically to maintain altitude.

14. From the middle throttle position corresponds to an airspeed of approx. 85 km/h. Attention, **no elevon movements can be carried out** on the RC system during the transition before airspeed has been reached.
    14.1. It is recommended to leave the throttle stick in the center position on the whole flight.
    14.2. Fly the aircraft at approx. 85 km/h IAS and continue to climb. The hover motors automatically shut down within 2 sec after airspeed is reached.

The flight can be continued as usual as a fixed wing aircraft. However, it must be ensured that in FBWB the position of the control sticks does not indicate the position of the rudder surfaces. The throttle position specifies the airspeed and not the engine speed. Accordingly, a stall condition cannot be recognized based on the position of the control stick. Flying by the speed indicated through the pitot tube is essential.

11.1 Cruise Flight

During transition to cruise, an economical speed of approximately 85 km/h IAS is recommended. Engine power requirements will vary according to aircraft weight. The maximum allowable speed, VNe, is 120 km/h IAS and should not be exceeded. In gusty conditions, the maximum recommended speed is VB, which is 90 km/h IAS.

The Generator has to be able to recharge the Battery so that the voltage should increase to its limit of 52V, not decrease below 48V. If the Battery Voltage decreases below 48V the Aircraft has to be landed.

11.2 Turning Flight Maneuvers

The flight controller automatically restricts curves that exceed a bank angle of 45°. Should a deviation from this limit occur, the aircraft will initiate a safe hovering flight by activating its hover motors. To resume FBWB mode, the operator can adjust the throttle position, allowing the aircraft to transition smoothly back to its designated safe starting speed, replicating the conditions experienced during take-off.

11.3 Manual Landing Maneuvers

- Inspect the landing site and announce: ATTENTION LANDING; others must move to a secure area.
- Land over a large area if possible, for easier configuration.
- Approach about 50m above the landing point, **against the wind**.
- Switch from FBWB to QLoiter around 100m before the spot.
- Gradually activate hover motors until speed is 0 km/h.
- Complete the approach in hover mode.
- In Q_Loiter, the aircraft holds position and altitude automatically; adjust only GPS position and descent rate.
- Use Q_Hover if QLoiter isn't possible due to wind or poor GPS/compass data.
- Reduce descent rate just before touchdown.

After touchdown and motors idling, the aircraft must be **disarmed by turning the throttle down and full rudder deflection to the left**.

12 Fail Safe Modes

- If the RC signal is lost, the flight controller response depends on the current flight mode:
- In **auto flight mode**, the aircraft continues its pre-programmed mission.
- In **Fly by Wire B** mode, the aircraft switches to **RTL** (Return to Launch) and returns to the GPS lock position.
- In **hover flight mode** above the GPS lock, the aircraft enters **Land Mode**.

13 Post Landing

Post Landing check-list

POST LANDING	
FLIGHT MODE QHOVER RESP. QLOITER	DEACTIVATE BY YAW TO THE LEFT
IGNITION AND GENERATOR	OFF
PILOT TUBE	COVER ON
FLIGHT DEVICE	OFF
TRANSMITTER	OFF
NOTEBOOK	OFF
RESCUE SYSTM HOVER BATTERIES	SECURED CHECK CHARGE LEVEL DELTA CELL VOLTAGE <0.1V

14 EMERGENCY PROCEDURES

The emergency procedures must be planned and trained in advance for each flight phase. A corresponding emergency procedure should be gone over in advance for each flight phase and initiated if needed.

In Qhover mode, the aircraft must not be flown backwards or backwards into the wind. The nose must be turned in the direction of flight before the forward flight is initiated in the hover.

No warranty is given for damage to the aircraft due to poor GPS, compass or barometer readings, in which case the aircraft must be put into hover mode and landed by hand manually.

EMERGENY PROCEDURES	
DISTURBANCE DURING HOVER TO STARTING ALTITUDE	HOVER BACK TO STARTING POSITION
FLIGHT DEVICE RISES OUT OF CONTROL IN THE QLOITER	SWITCH TO QHOVER AND LAND
PROBLEMS IN TRANSITION	EITHER IN QHOVER OR QLOITER MODE BACK TO START POSITION
THE YAW STABILIZATION deviates by more than 15 °	EITHER IN QHOVER OR QLOITER MODE BACK TO START POSITIONWIND CHECK WINDDIRECTION
STALL	HOVER MODE AND BACK TO FBWM
HOVERMODE CANNOT BE EXECUTED IN FLIGHT	ACTIVATE RESCUE DEVICE

FLIGHT DEVICE NO LONGER CONTROLLABLE	ACTIVATE RESCUE DEVICE
FLIGHT DEVICE NO LONGER VISIBLE	ACTIVATE RTL MODE
FLYING DEVICE OVERLAPS STARTING OR LANDING	QUICKLY DEACTIVATE BY YAW TO THE LEFT
FRONT DRIVE FAILS	WHEN POSSIBLE GLIDE TO STARTING POINT AND HOVER TO GROUND
CANCEL RTL MODE IN FLIGHT	SWITCH TO FBWB
CANCEL RTL MODE IN HOVER	SWITCH TO QHOVER MODE
HOVER PROPELLER FAILURE IN THE HOVER FLIGHT OR IN TRANSITION	CAREFULLY LAND ON A LEVEL SURFACE IN QHOVER MODE
FLIGHT DEVICE CAN NOT BE SWITCHED OFF	PULL KILL SWITCH TO DISCONNECT POWER SUPPLY

15 Handling

15.1 Handling

The aircraft can be moved by hand or lifted by two people. The six Hover Motor mounts are the right areas to lift the aircraft.

15.2 Parking

In severe weather or high winds, anchor the aircraft securely or disassemble and store it in a vehicle.

When anchoring, use suitable weights or screw anchors to hold the aircraft securely.

- If possible, position the nose into the wind.
- Fasten ropes or straps (not chains, wire, or steel bands) to the undercarriage.

16 Weighing and loading plan

Check the aircraft's centre of gravity before each flight or after adjusting its weight distribution.

Install screw eyes in the M5 bores outside the centre of gravity marks on the payload bay root ribs.

Lift the aircraft (using a luggage scale, if needed) and use the spirit level to check its attitude. If the bubble is outside the marked area, adjust the centre of gravity by repositioning the batteries.

Ensure the batteries are securely fastened.

17 Typeplate and labelling

A metal plate with the LBA registration number must be attached to the aircraft.

Another typeplate was installed by the manufacturer in the front of the payload bay.

18 Assembly / Disassembly / Case Storage

The wings can be removed for transport.

In a first step the provided support must be attached to the rear of the fuselage.

Then the locking cap must be turned 180 ° forward over the wing bolts.

The wing bolt can now be pulled out on the key ring with a slight twisting motion. Attention, if the wing supports have already been removed, the wing must be protected of dropping.

The wing can now be carefully removed from the plug connections and the spar brackets.

1. Disasemble the right wing, put it with the trailing edge first into the case and remove the wing landing strut. Fold Propellers into wing spar direction.

2. Disasemble the left wing, put it with the trailing edge first into the case and remove the wing landing strut. Fold Propellers into wing spar direction.

3. Under the Fuselage the aft propellers have to be folded forward and the Front Propellers have to be folded inward.

4. Set the Fuselage into the case on top of the wings. The lower fin is lowered in advance.

Attention: The rear folded propellers must rotate freely in the case to prevent damage to the propeller blades during transport.

19 Care

Care:

All metal parts are corrosion-proof and do not require any special care.

We recommend using Washing petrol to remove Oil from the Aircraft.

Under no circumstances should solvents or cleaning agents containing acetic acid be used.

19.1 Rudder deflection of Elevons

Deflections of the elevons are measured from the rear tip of the elevon root down to the trailing edge of the wing.

Deflection of Ailerons:

Upward	28 mm
Downward	18 mm

Deflection of Elevators:

Upward	26 mm
Downward	19 mm

20 Mission planning for automatic flights

Based on the following aircraft parameters, the energy requirements can be determined. We recommend to plan a remaining fuel capacity of at least 10%. For cross-country flights, the wind conditions must be taken into account in particular the headwind at flight altitude. Higher battery capacities may allow for lower residual capacities. However, these should be carefully tested. For cross country flights the distances to be covered as well as the prevailing wind conditions have to be taken into account.

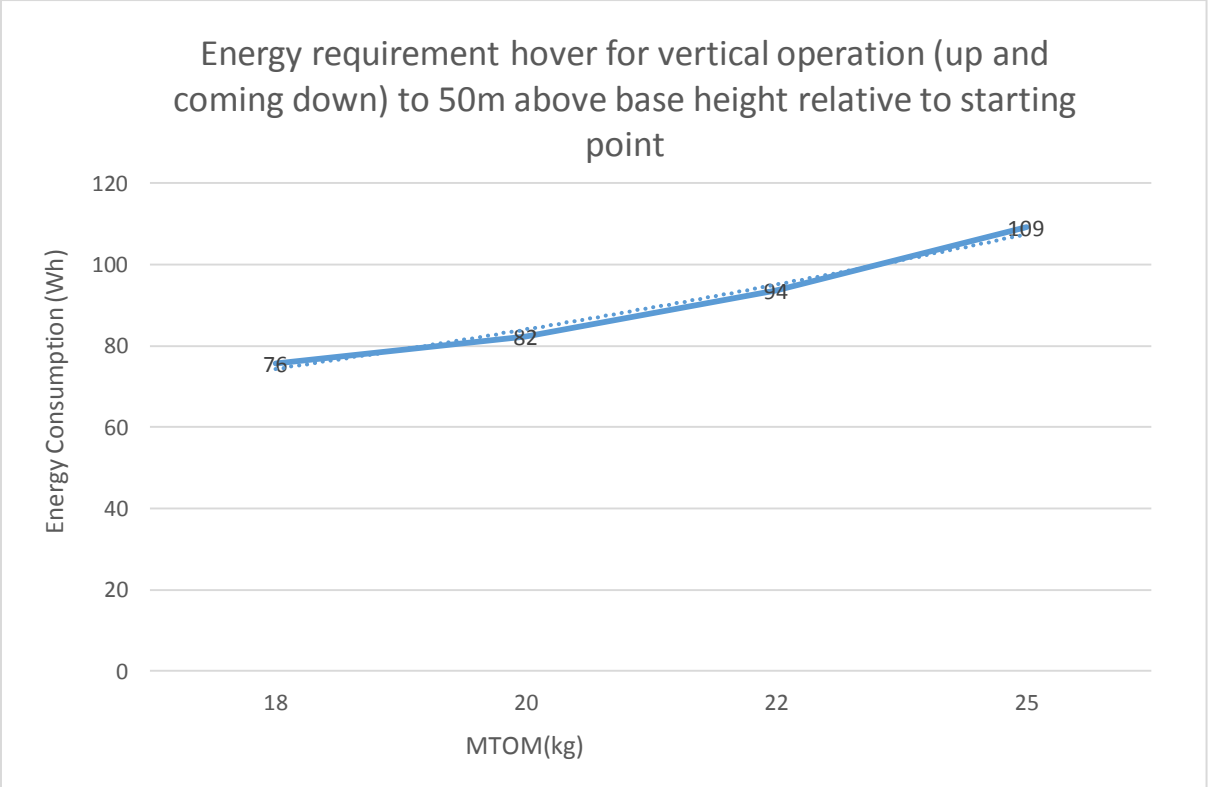
When planning autoflights with QGroundcontrol, the following has to be taken into account:

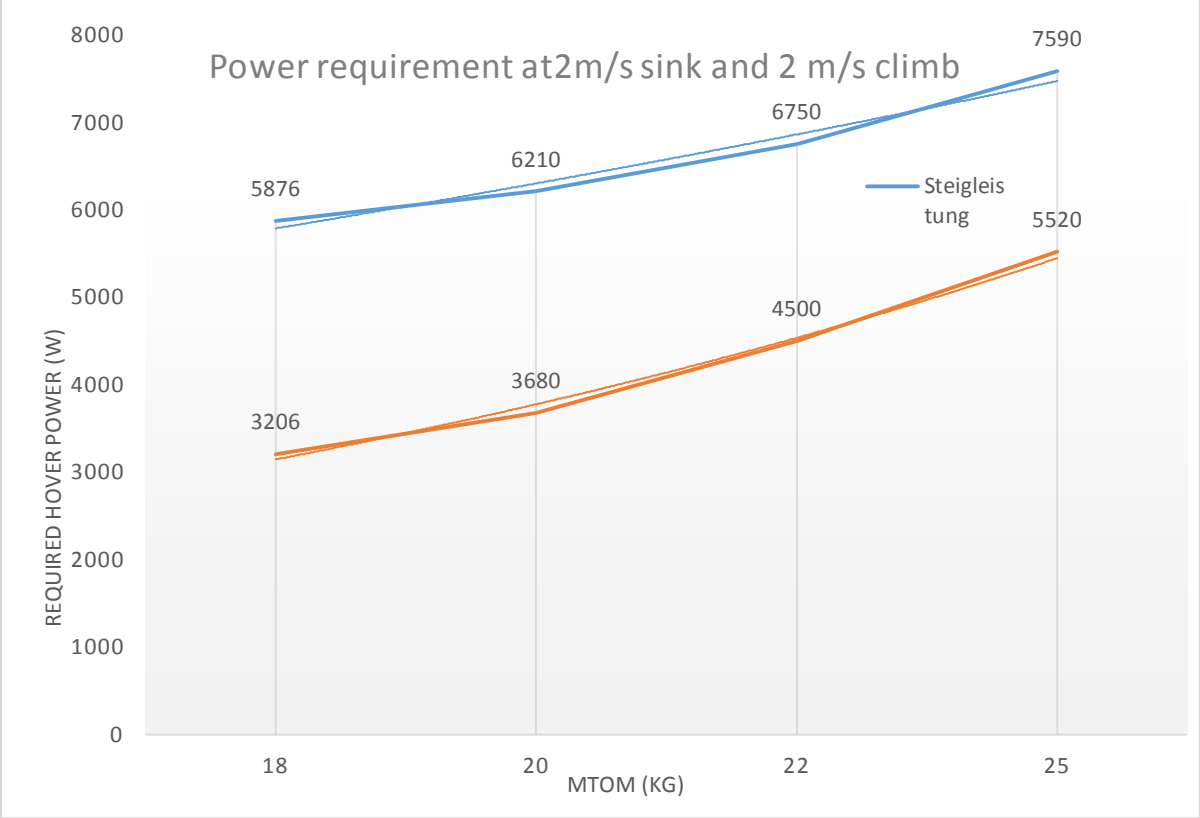
- Choose aircraft type as VTOL
- Cruise flight for example 120m
- Select VTOL Start and set a transition height of 50m (the hight should be set to at least 20-30 m above highest obstacle)
- Set flight speed to 85km/h
- Allow for first waypoint to travel at least 400m distance
- Further waypoints within visual line of sight (1 km)
- Choose last waypoint as RTL
- Check all waypoints in the bar-graph of GCS
  Upload mission!

20.1 Checklist Mission planning

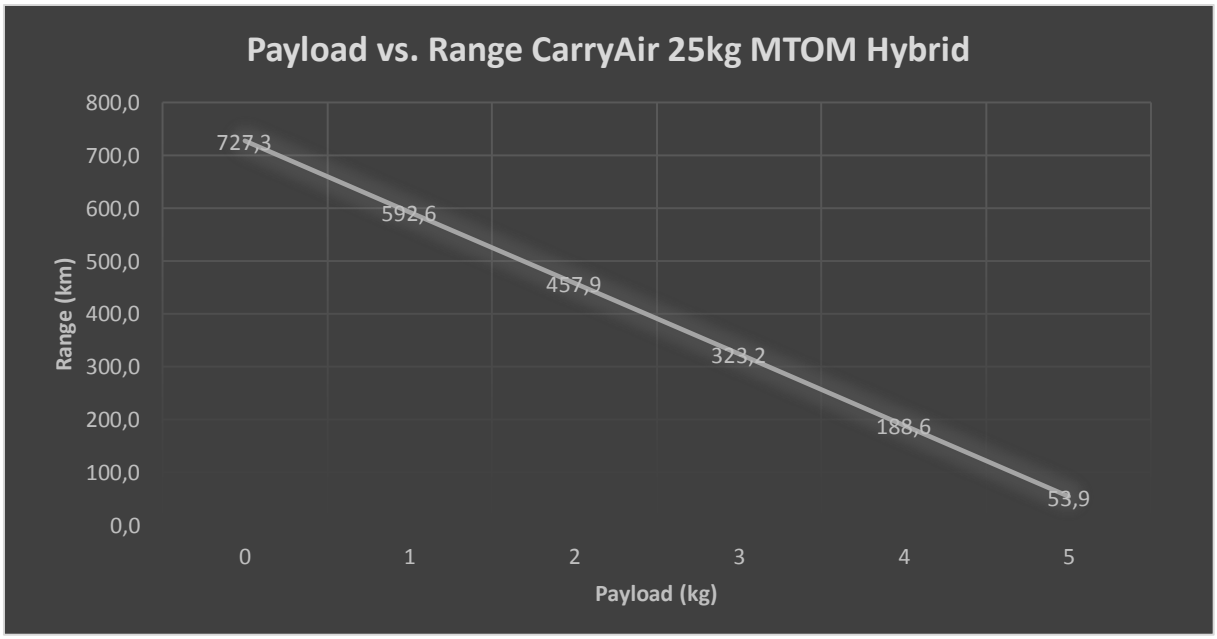
Flight Planning QGC					
Aircraft	Unplug Battery				
Controller	Switch on and start GCS				
Go to flight planning	Select menu file				
Create Plan	Choose Blanc				
Under Mission Start	Select VTOL Aircraft (Flight Level relative to GPS Lock) Firmware Ardupilot				
Flight Speed	85 km/h				
Hover Speed	15 km/h				
Menu option Takeoff	VTOL Takeoff on 50m Height, heading default				
Menu option Waypoint	Set first Waypoint approx. 400m in distance into the wind at approx. 70m altitude				
Menu Option Waypoint	Other Waypoints up to max 120 m above Ground Level or a Survay with a typical spacing of 120m				
Menu Option Waypoint	Last Waypoint select RTL (klick on Triangle beside Waypoint and klick on RTL)				
Altitudes above ground	Check Bar graph for flight altitude above ground level				
Mission	Upload				

21 Performance and Energy Requirements





Payload vs. Range / Hybrid 25kg MTOM



22 Maintenance

The proportion of mechanically complex components was deliberately kept at a minimum during the developement of CarryAir.

The individual components and electrical installation of the aircraft have to be checked according to the following table and according to the specified maintenance intervals.

22.1 General Maintenance Instructions

- All maintenance must be carried out by competent personal according to the maintenance table.

- All repairs and changes must be reported and tested

- Repairs: The owner may only carry out repairs as they relate to exchange of defective components.

- For purposes of replacement only original parts can be used. Components may not in any shape or form be repaired.

22.1 Compass Setup

An improperly calibrated compass can disable the aircraft from arming. One reason for this may be that the aircraft has to be flown in the southern hemisphere and it has been calibrated in the northern hemisphere.

Please follow the steps below to calibrate the compass.

First Step: Large Aircraft Basic setting with Mission Planner

1. Open the latest version of the Mission Planner firmware on your PC.
2. Set up the aircraft outdoors, as far away from metallic objects and buildings as possible, and align it with a compass (Handy Compass app if necessary).
3. Connect the drone to the computer with a USB cable. Plug the USB cable into the USB micro connector on the cable in the rear electronics area of the flight controller.
4. Click on "connect" in the upper right corner of Mission Planner and select Auto or the appropriate Mavlink Cube orange COM if the connection fails.
5. Go into the menue Setup of the mission planner and choose the compass setting on the left side.
6. Choose “Large Aircraft” in the bottom area.
7. The aircraft must have enough Satellites to get the GPS Lock.
8. Fill in the right Heading that is shown on your compass into to text field of the Mission Planner.
9. Check the Heading of the Compass on the flight controller and compare it with the other compass.

Second Step: Manual input of compass values from the flight log

The most precise calibration is achieved by determining the compass values from the last flight log which the aircraft should have flown for a few minutes.

1. Send the Log file to the Manufacturer
2. Get the calibrated compass values from the manufacturer
3. Open in GCS on the Flight controller “Vehicle Setup” (gear icon)
4. Choose “Parameter” on the bottom left
5. Enter all compass values manually

22.2 Maintenance Combustion Engine

Regular maintenance is essential for the operational safety, reliability, and service life of both the engine and the entire flight platform. Please carry out the following inspections and tasks carefully at the specified intervals.

⚠ **Safety Notice**:
Before performing any maintenance, stop the engine, switch off the ignition, and secure the propeller. Only use suitable tools and observe the tightening torques (see separate table).

22.31. Before Each Flight

- **Visual Inspection**
  - Check engine, ignition, and all mounting screws for tight fit.
  - Inspect engine mount, motor dome/engine support, vibration dampers, and firewall for tight fit, cracks, or play.
  - Inspect propeller for cracks, dents, or other damage.
  - Check fuel lines for leaks, brittleness, or kinks.
  - Inspect air filter for cleanliness, clean if necessary.
  - Check muffler and exhaust mounting for loose screws or leaks.

- Inspect throttle servo and linkage for wear, secure fit, smooth and play-free operation.

- **Function Check**
  - Test magneto ignition by carefully rotating the propeller (smooth resistance, no knocking or scraping sounds).
  - Check throttle and choke linkages for smooth and free movement.

22.42. After the First 2 Flight Hours

- Retighten the three **M5 screws** passing through the rubber vibration dampers of the engine mount to **6.5 Nm**.

22.53. Every 50 Flight Hours

- **Engine Mount & Fasteners**
  - Retighten the three **M5 screws of the engine mount** to **6.5 Nm**.
  - Inspect engine mount, motor dome/engine support, vibration dampers, and firewall for cracks, play, or material fatigue.
  - Retighten engine mounting screws and engine support (tightening torques, see table).
- **Engine & Ignition**
  - Remove spark plug (type: according to manufacturer's specification), clean or replace if worn. Check electrode gap.
  - Replace spark plug if service life is exceeded.
  - Check and, if necessary, adjust magneto air gap (**target: 0.10–0.20 mm**).
  - Clean cylinder head and cooling fins from dust, oil, and deposits (ensure optimal cooling).
- **Carburetor**
  - Check carburetor for secure fit and inspect seals.
  - Inspect carburetor membranes and gaskets, replace if necessary.
- **Exhaust System**
  - Check for leaks and play
- **Air Intake & Propeller**
  - Clean or replace air filter.
  - Inspect propeller hub and drive washer for tight fit.
- **Fuel System**
  - Replace all fuel lines if there are any signs of aging (cracks, hardening).

22.64. TBO Check after 300 hours at the manufacturer

- Remove the engine completely and perform a thorough inspection for wear, corrosion, or damage.
- Check crankshaft oil seals for tightness.
- Inspect bearings for smoothness and absence of play.
- Replace in-tank fuel filter.
- Check ignition wiring for insulation damage and secure connections.
- Preserve the entire power system according to manufacturer's guidelines if the aircraft will be stored for more than 3 months.

22.75. Adjustments

- **Carburetor Basic Setting**
  - High needle (H): **¾ turn open**
  - Low needle (L): **1¼ turns open**
    → Fine-tuning must be performed in operation depending on weather, temperature, and propeller load.

- **Ignition**
  - Magneto air gap: **0.10–0.20 mm**

22.86. Fuel

- Only use high-quality, premixed fuel:
  - **Aspen 2** (alkylate fuel with 2-stroke oil), or
  - **Aral Ultimate** 102 (Gasoline E0) mixed with fully synthetic 2-stroke oil at a ratio of **1:50**.

22.9 General information about bolt joints

All bolt joints must be secured with Locktite or with new lock nuts except the M3 bolts for the folding propellers.

The control rods on the elevon servos are to be secured by safety wire so that the spring clips for attaching the fork heads are looped with the wire.

- For thread sizes M4 or larger, medium-strength threadlocker of the type Locktite 243 has to be used.

- For thread sizes M3, low-strength threadlocker of the type Locktite 222 has to be used.

Torques of the different screw connections:

Bolt diameter	Torque
M3 plus Locktite 222	1 Nm
M3 Propeller Grade 12.9 no Locktite	2 Nm
M4 In 3D printed Polyamide engine mounts plus Locktite 243	0,8Nm
M4 in all metall parts like Motors plus Locktite 243	2.5 Nm
M4 4 ea. for Starter generator mounting plate	3 Nm
M5 plus Locktite 243	4Nm
M5 Bolts for combustion rubber motor mounts	6,5 Nm
Screw terminals main power distributor red / blue	2,5Nm
Front propeller screws M8 NO Locktite Retighten after the first 10 flight hours or 2 month after first test flight Degrease propeller shaft and clamping cone inside 6mm properly with brake cleaner	15 Nm

Checklist of all mechanical components

The TBO for this aircraft is 300 hours of flight. The aircraft has to be send back to the manufacturer for detailed inspection.

The 50 hours check requires a maintenance training by the manufacturer.

The prescribed maintenance intervals of the manufacturer of the additionally installed components must be observed.

- Payload
- Control system
- Combustion Engine
- Batteries

Before all inspections clean aircraft with a mild dishwashing detergent

Intervall hours	preflight	50	Operation
	x		Check the fuselage and wing for damage
6 pcs. Hover motors		x	Check bearing play and bearing noise Inspect the motor for any deformities by checking the gap between the motor and its base is even and its spins freely. If not sure, refer to the workshop for further inspection.
2pcs. Front motor		x	- Check for bearing play and bearing noise. - Check the bolting points on the CFRP motor mounts. - Tighten the propeller with a torque of 15 Nm. Attention, a second wrench must be placed from the inside behind the rear motor so that the torque is also applied to the rear clamp connection.
Front and aft undercarriage	x		Check for cracks and play in the bolting points
Wing supports outside		x	Check adjusting rings for tight fit and plastic clamping. It should be possible to turn the feet with slight friction.
Hover Propellers	x		- Check blade root tightening points. The blades must be able to move backwards with light fingertip force, but must not have any play. - Gently slide propeller between two fingers and feel if there are any chirps, crack or damage on the propellers. Replace if the damage is visible and may compromise a safe flight.
Frontpropeller and Spinner	x		Check for cracks If the aircraft shows louder vibrations in flight than usual, rebalance the spinner and propeller. Contact the manufacturer for this.
Wing connection bolts		x	Check for play

			Check for cracks Check for wear
Rudder Linkages	x		Check hinges for hairline cracks Check rudder horns for cracks and tight fit. Check clevises with locknuts and wire retainers for cracks and tight fit.
Payload Bay	x		Check hinges (play, cracks) Check Payload attachment Remove Dust or loose parts Check door closer Check Rescue system
Servos			Check servos for servo play and servo noise. If you notice a significantly larger rudder play as well as a trembling of the servos, they must be replaced.

22.10 Checklist of electrical components

Intervall hours	preflight	50	Operation
Automatic Motor connectors in the wing rootrib	x		Contact sockets centered in plug center, not bent? Plug housings may have slight play, but should be held firmly in position
Cables		x	Check for abrasion, insulation and tight fit
Battery Plugs	x		Check for abrasion, insulation - Check for tight fit - Check for discoloration and high temperatures due to melted insulation.
Screw terminals main power distributor red / blue		x	Retighten screws with the specified tightening torques

Flightcontroller / Kompass / DC-DC Board /Airspeed sensor / Motorcontroller etc.		x	- Check for tight fit - Check for discoloration and high temperatures due to melted insulation.
Positionlights		x	- Clean contact surfaces of the automatic connectors - Check the function of the lights - Check screw connections of the lights for tightness.
Payload		x	Use Checklist of the manufacturer of the payload itself
Electrical main terminal Plus an Minus Block		x	Tighten the Screws to clamp the cables of the main connector for the first time after 10 Flight hours and later in a 50 Flight hour interval.

22.1 Checklist 2 Stroke combustion engine

Intervall hours	preflight	50	Operation
Engine mount		x	Retighten the three **M5 screws** to **6.5 Nm**.
Engine Ignition		x	Remove spark plug (type: according to manufacturer's specification), clean or replace if worn. Check electrode gap. Replace spark plug if service life is exceeded. Clean cylinder head and cooling fins from dust, oil, and deposits (ensure optimal cooling).
Magneto		x	Check and, if necessary, adjust magneto air gap (target: **0.10–0.20 mm**).
Carburettor		x	Check carburetor for secure fit and inspect seals. Inspect carburetor membranes and gaskets, replace if necessary.
Exhaust System		x	Check for leaks and play
Air Filter		x	Clean air filter if needed.
Propeller drive		x	Inspect propeller hub and drive washer for tight fit.
Fuel System		x	Replace all fuel lines if there are any signs of aging (cracks, hardening).

	Special reworking / replaced Components	Signature / Date
After 50 h		
After 100 h		
After 150 h		
After 200 h		
After 250 h		
TBO 300 h (At manufacturer)		
After 350 h		
After 400 h		
After 450 h		
After 500 h		

Basic drone maintenance/repair toolkit

Hand Tools

- Screwdrivers Slot and Phillips medium and small
- Hex wrenches (2,5mm, 3mm, 5mm)
- Torx Screwdriver T8, T10, T20
- Pliers and Wire cutters/strippers
- Torque Screwdriver 0,8Nm, 1 Nm, 2Nm, 3Nm, 4Nm, (VANPO Digitale 1/4", 0.3-6Nm)
- Torque wrench with 14mm Nut @ 15 Nm (Wera 05075604001 Click-Torque A 5)
- Long 2.5 mm adapter for Nm torque wrench (For Propeller hub 2 Nm)
- Wrench Set 5,5mm – 14mm

Electrical Tools

- Crimping clamp
- Crimping connectors
- Hot air gun
- Heat shrink tubes
- Electrical tape
- Cable ties

Cleaning Equipment

- Lint-free cloths
- Compressed air can
- Isopropyl alcohol
- “Presto” (acetone free) brake cleaner

Calibration Tools

- Multimeter
- Spirit level
- Measurement tape