

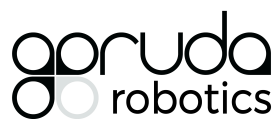
aria 500

Uncrewed Aircraft System



User Manual

Version 1.1 | 9 October 2024



Garuda Robotics
<https://garuda.io>
hello@garuda.io

Versions

v1.0	2024-09-04	Initial release
v1.1	2024-10-09	Updated components

About This Manual

This user manual provides the basic information you need to set up, operate and maintain your Uncrewed Aircraft System (UAS). On its own, this manual is not intended to be sufficient to ensure safe and compliant drone operations.




The UAS consists of an Uncrewed Aerial Vehicle (UAV) and accompanying equipment. Your UAV is a sophisticated device and is solely intended for use by trained and licenced professionals. Before conducting any UAS operations, ensure that you have fully read and understood this manual, particularly the following sections:

- Before You Fly;
- Compliance;
- Acceptable Use Policy; and
- Warranty.

The information contained in this manual has been verified to be accurate at the time of publishing. You may download the latest version of this manual from the product website at any time.

Updates to operations software may have been implemented since the time of writing of this user manual. As a result, there may be differences across images and/or terms used in this document and in the actual operations software. Unless the changes are critical, new updates will be included in the next version of this manual. Critical updates will be communicated to users in the form of amendment bulletins to highlight the changes.

Some sections of this manual may be annotated with one or more of the following icons:

	NOTE	Indicates important information that helps you make better use of your UAS.
	CAUTION	Indicates potential hardware damage or data loss if instructions are not followed.
	WARNING	Indicates potential for property damage, personal injury, or death if instructions are not followed.

Contents

About This Manual	3
About Your Uncrewed Aircraft System	5
Features	5
Support	5
Before You Fly	6
Package Contents	7
Standard Package	7
Additional Items	7
Accessories	7
Specifications	8
Aircraft	8
Handheld Controller	9
Ground Control Station (GCS)	9
Aircraft Performance	9
Radio Frequency Systems	9
Identifying Parts and Controls	10
Aircraft	10
Handheld Controller	11
Setting Up the Aircraft	11
Initial Hardware Setup	11
Charging the Batteries	11
Handheld Controller and GCS Setup	13
Charging the Controller	13
Turning On the Controller	14
Controller Flight Modes	14
Connecting a GCS via USB	14
Failsafe Configuration	14
Operating the Aircraft	16
Setting Up the Aircraft	16
Powering up the Aircraft	16
Arming the Aircraft	17
Care and Maintenance	18
General Care	18
Operating Environment	18
Charging and Power	18
Acceptable Use Policy	19
Compliance	19
Appendices	20
Preflight Checklist Samples	20

About Your Uncrewed Aircraft System

The aria 500 UAS by Garuda Robotics is an industrial grade multirotor uncrewed aircraft designed for flight operations in manual, semi-autonomous or fully-autonomous modes both indoors (GNSS-denied) and outdoors. The onboard mission computer supports development of custom flight logic and enables access to a variety of situational awareness sensors.

All aircraft are designed, built and tested in-house by Garuda Robotics in Singapore.

Features

- High thrust to weight ratio enabling agile and high speed flight manoeuvres
- Multiple high-fidelity positioning and sensing systems for GNSS-denied operations
- Failsafe detection and recovery from low battery, RC signal loss, and geofence breach



WARNING

BVLOS operations require careful testing. Please consult your local civil aviation authority before performing BVLOS operations!

Support

For all technical support and warranty matters, please contact support@garuda.io.



WARNING

All after-sales servicing and support (if any) must be carried out by Garuda Robotics or its appointed agents. Any unauthorised disassembly, modification, or attempted updates to the UAS may result in personal injury and/or void your warranty.

Before You Fly

Ensure that:

1. You are familiar with your local aviation regulations and only conduct flight operations within the permissible scope of operation granted to you by the appropriate authorities;
2. You and your team have read and understood this user manual and are familiar with the UAS;
3. You have obtained all necessary training, permits, insurance, and authority clearance;
4. You have completed all necessary pre-flight checks; and
5. All safety precautions are taken to ensure the safety of the public and all involved personnel.



WARNING

It is the UAS operator's responsibility to be familiar with and only operate the UAS in accordance with the local unmanned aviation rules and regulations. Failure to comply may result in voiding of warranty and/or legal penalties. Please refer to the Appendices for further details.



NOTE

It is highly recommended, and may also be a regulatory requirement, that a comprehensive pre-flight checklist be developed and customised for your specific context. Such a checklist will typically include regulatory, environmental, risk, and platform assessments. Garuda Robotics assists many clients with the development, automation, and management of such checklists. Write to sales@garuda.io for more information.

Package Contents

Your aria 500 typically ships with the components shown below.

Standard Package

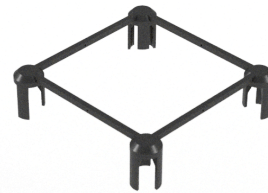
aria 500 Uncrewed Aircraft



Handheld Controller



Rotor interlock guard



Additional Items

LP6100 Cerana Flight Battery



NOTE

Some items may be optional and may not ship with your UAS. Some components may not be available in certain countries. Contact your local distributor for details.

Accessories

Your package comes supplied with all equipment required to get started.

You may purchase additional batteries, rotors, and other accessories from Garuda Robotics or your preferred authorised reseller.

Specifications

Aircraft

Dimensions	Standard configuration	515 mm (W) × 515 mm (D) × 230 mm (H) 630 mm (diagonal)
Weights	Dry weight (no battery) With standard battery Maximum Takeoff Weight (MTOW)	1,850 g 3,150 g 4,400 g
Performance	Flight time with no payload Maximum height (service ceiling) Maximum speed Wind resistance	15.5 min 400 m AMSL 8 m/s 8 m/s
Propulsion	Configuration Rotor diameter Rotor material	Quadrotor 8" (203 mm) Nylon
Avionics	Mission Computer Flight Control Computer IMU (FCC) IMU GNSS	Orin NX 16GB mRo Control Zero H7 Triple, redundant VectorNav VN-100 Here4 F9P
Awareness	FCC Downward sensing Upward sensing Mission Computer Forward camera 360 degree VIO Downward sensing UWB	Benewake TFmini-S Benewake TFmini-S AR0234, 60° (H) x 40° (V) FOV Vilota VK180+ Combo ams TMF8821 Nooploop P-BS2
Connectivity	Frequencies Manual control Handheld controller Datalink	2.4 GHz ISM ELRS 2.4GHz Jumper T15 ELRS Rajant BreadCrumb DX2
Control	VLOS operations Ground Control Station	Handheld controller Mission Planner GCS (via USB)
Power	Battery Battery chemistry Battery voltage Cell configuration Capacity (per battery) Discharge rate Weight (per battery)	LP6100 Lithium Polymer 22.2V 6S1P 10,000 mAh 20C / 200A 1,300 g
Environmental	Operating temperature	0°C to 50°C (32°F to 122° F)



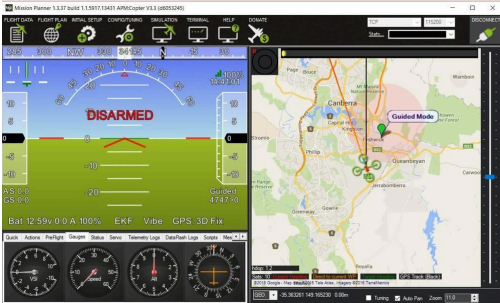
CAUTION

You are responsible for ensuring that the aircraft is operated within its stated weight limits.

Handheld Controller

Screen	Size Controls	3.5-inch Capacitive touch
Controls	Control sticks	2x Hall Effect gimbals
Radios	Operating frequencies	2.4 Ghz (ISM / SRD)
Power	Battery Charging	2x 21700 Li-Ion USB-C

Ground Control Station (GCS)

Visual Line of Sight (VLOS) flight operations	Mission Planner This application requires a Windows laptop and is recommended for advanced users who are familiar with the Ardupilot ecosystem.	
---	--	--

Aircraft Performance

Thrust	Maximum thrust Thrust to weight ratio (rated AUW) Thrust to weight ratio (MTOW)	9,800 g 3.11:1 2.28:1
Endurance	Hover endurance (rated AUW)	Maximum 15.5 min 14.5 min (with 10% battery reserve) 12.5 min (with 20% battery reserve)

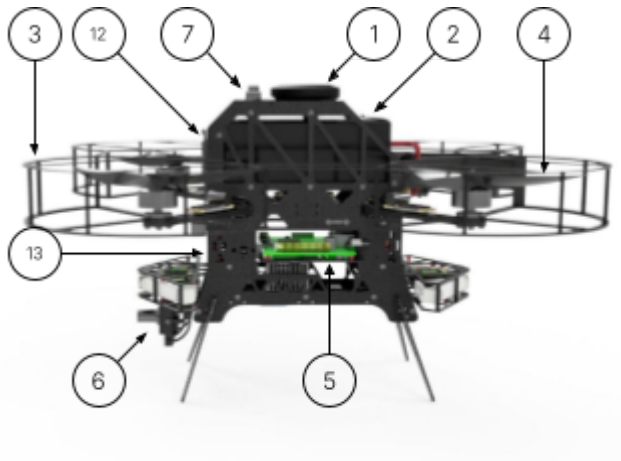
Radio Frequency Systems

Manual control	Frequencies Protocol	2.4GHz ExpressLRS
	Transmitter Power Range	Jumper T15 ≤ 100 mW EIRP Maximum 4km
	Receiver	Jumper Aion Mini
Datalink	Frequencies Radio Power	2.4GHz Rajant DX2 ≤ 100 mW EIRP
UWB	Frequencies Radio Power	4243–4742 MHz Nooploop P-BS2 ≤ -41.3 dBm/MHz EIRP power density

Identifying Parts and Controls

Aircraft

Side View



Bottom View



-
- | | |
|----|--|
| 1 | GNSS antenna |
| 2 | LP6100 22.2V 10,000 mAh LiPo battery |
| 3 | Rotor guard |
| 4 | Rotors |
| 5 | Orin NX Mission Computer |
| 6 | Forward camera |
| 7 | TFmini-S upwards TOF sensor |
| 8 | TFmini-S downwards TOF sensor |
| 9 | Vilota DP180 Pro + DP180 Pro Nadir VIO |
| 10 | VectorNav VN-100 IMU |
| 12 | Rajant DX2 mesh radio |
| 13 | Nooploop P-BS2 UWB |
-

Handheld Controller

Front View



-
- | | |
|---|----------------------------------|
| 1 | Power Button |
| 2 | Throttle / Yaw Stick |
| 3 | Pitch / Roll Stick |
| 4 | Switches |
| 5 | Antennas |
| 6 | 3.5" capacitive touch screen |
| 7 | USB-C charging and firmware port |
-

Setting Up the Aircraft

Initial Hardware Setup

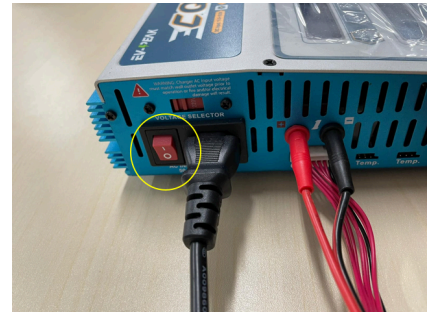
Charging the Batteries

Connect the XT90 charging cables and balance boards for all four segments of the battery charger.



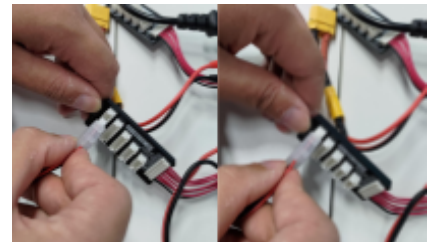
Connect the charger to the mains outlet.

Turn on the charger.



Using the XT90 and balance port connectors, connect the batteries to be charged to the charger.

Each battery's XT90 and balance port connectors must be connected to the same charging segment.



Press "BATT TYPE".

Under PROGRAM SELECT, choose "LiPo Battery".

Press "START" once.



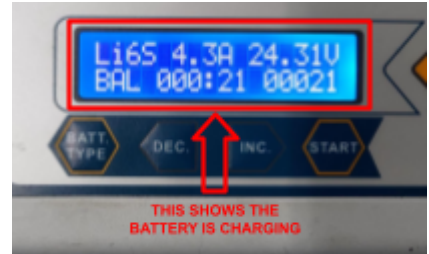
Press "START" once and select "6S". Use "DEC." and "INC." to change your selection.

Press "START" once and select "BAL-CHG" and do the same for "C=10000mAh".



Press and hold "START" for at least 3 seconds until you hear the beeper sound.

Press "START" once to begin charging.



When battery charging is complete, the charger will make a beep sound with a tune.

Press "BATT TYPE" to return to main settings before disconnecting the battery.

To stop charging, press "BATT TYPE" once.



To check the voltage value on each individual cell, press "INC" while the battery is charging.

The voltage for each cell must not exceed 4.2V.



! **WARNING** Take care when handling and charging Lithium Polymer batteries. Do not overcharge the batteries or leave them charging unattended. Store batteries in a cool, dry place away from heat.

Handheld Controller and GCS Setup

Charging the Controller

Connect a USB-C cable to the USB-C port on the top surface of the Handheld Controller.

Connect the other hand of the cable to a charging port.

The flight mode buttons indicate the controller battery charging status.

Turning On the Controller

Press and hold the Power button for 3 seconds to turn the controller on.



Controller Flight Modes

Guided
AltHold
Stabilize

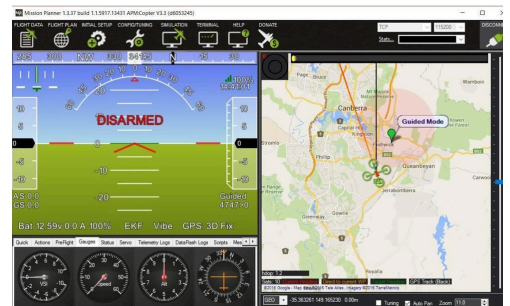
Auto
Land
Loiter

Connecting a GCS via USB

Locate the USB-C port on the left side of the aircraft.

Plug in a data-capable USB-C cable and connect the other end to the computer running the GCS application.

Connect to the aircraft from the GCS application.



Failsafe Configuration

Failsafe settings are critical safety parameters that must be set correctly.


The aircraft is configured with a series of failsafe behaviours to ensure safety of flight during emergency situations.

You should configure the failsafe settings according to the requirements of your specific flight operations.

The default failsafe settings are listed below for reference.

Failsafe	Behaviour	Threshold(s)	Configuration Parameters
----------	-----------	--------------	--------------------------

Battery Low	Warning message will be sent via telemetry that Battery Low is reached	30% battery (3,000mAh remaining) or 21.6V, whichever is lower	BATT_FS_LOW_MAH = 3000 BATT_FS_LOW_VOLT = 21.6 BATT_FS_LOW_ACT = 0 (NONE)
Battery Critical	Warning message will be sent via telemetry that Battery Critical is reached Drone will enter 'LAND' mode and land	10% battery (1,000 mAh remaining) or 20.0V, whichever lower	BATT_FS_CRT_MAH = 1000 BATT_FS_CRT_VOLT = 20 BATT_FS_CRT_ACT = 1 (LAND)
Breaching Geofence	Warning message will be sent via telemetry that Geofence is breached Drone will enter 'BRAKE' mode and hover		FENCE_ACTION = 4 (BRAKE or LAND)
No heartbeat from Orin NX	Warning message will be sent via telemetry that no OCS is detected Drone will enter 'LAND' mode and land	Timeout 2s	FS_GCS_ENABLE = 5 (LAND) FS_GCS_TIMEOUT = 2 sec
No RC detected	Drone will enter 'LAND' mode and land	Timeout 2s	FS_THR_ENABLE = (ENABLED ALWAYS LAND) RC_FS_TIMEOUT = 2 sec
EKF not reliable	Warning message will be sent via telemetry that EKF is inaccurate Drone will enter 'LAND' mode and land	Variance 0.8	FS_EKF_THRESH = 0.8 FS_EKF_ACTION = 1 (LAND)

 **WARNING** The pre-configured failsafe settings have been selected based on the outcome of a detailed risk analysis and mitigation process. Modifying the failsafe settings from their pre-configured state is not recommended and is undertaken entirely at the operator's risk.

Operating the Aircraft

Setting Up the Aircraft

Lift the aircraft vertically to remove it from the storage case.

Remove the rotor interlock guard by lifting it up vertically until it clears the rotor blades.



Check that the rotors are properly installed and the locknut is not loose.



WARNING

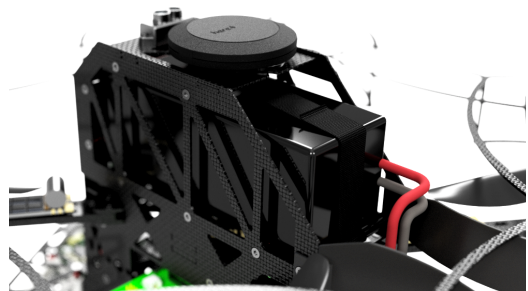
The rotor interlock guard serves as protection against unwanted or unintended motor activation. Repeatedly operating the aircraft with the interlock guard installed may cause damage to the motors, electronic speed controllers, and rotors.

Powering up the Aircraft

Place one Cerana Flight Battery LP6100 into the battery compartment of the aircraft.



Secure the battery using the velcro strap.



The XT90 battery connector is designed to allow insertion in one orientation only.

Ensure the battery plug is correctly aligned with the socket on the aircraft fuselage.

Connect the battery by firmly and quickly inserting the XT90 plug fully into the aircraft jack.

The aircraft's systems will immediately power up.



Arming the Aircraft

Ensure that there are no error messages from the GCS and that the correct flight mode is selected.

Ensure that the aircraft vicinity is clear of any personnel or obstacles.

This diagram is for illustrative purposes only. Local regulations may differ.



Once Pre-Flight Checks have been completed, arm the aircraft by pushing and holding the left control stick fully down and to the right.

The aircraft should arm its motors and spin them.

Gently release the left control stick back to the neutral center position, or hold it at a low throttle position.

Check that all motors are spinning smoothly.

If no problems are detected, you are ready for takeoff.

Firmly and decisively command the aircraft to takeoff by pushing the left control stick up until the aircraft lifts off from the ground.

Maintain an above-neutral throttle position until the desired holding altitude is attained.



CAUTION

The deflection on the control sticks directly determines the inputs commanded to the aircraft. Exercise caution and familiarise yourself with the characteristics of the aircraft and its controls before commanding maximum deflection of the sticks.

Care and Maintenance

You have purchased a sophisticated aircraft with sensitive components. Although it is designed to operate in a variety of environmental conditions, you should take proper care of your aircraft to ensure optimum performance.



WARNING

Your aircraft uses Lithium Polymer rechargeable batteries. Follow the recommended procedures for safely charging and operating your aircraft.

General Care

- 1 Do not disassemble the aircraft. Unauthorised disassembly of the aircraft will void its warranty.
 - 2 Do not insert foreign objects into the aircraft.
 - 3 To prevent electric shock, explosion, or other injury, do not operate the aircraft if it has been damaged in any way, whether by immersion in liquid, crushed by mechanical forces, etc.
 - 4 Do not subject the aircraft to extreme forces such as crushing, bending, puncturing, or shredding. Avoid placing heavy objects on the aircraft.
 - 5 Do not drop the aircraft.
 - 6 Store the aircraft in a cool dry place when not in use.
-

Operating Environment

- 1 Do not submerge the aircraft in liquids of any form. The aircraft is designed to resist splashes but is not waterproof.
 - 2 Avoid using the aircraft in extremely dusty conditions. The aircraft is designed with limited dust resistance, but using it in environments with plenty of fine particles may cause its performance to degrade over time.
 - 3 Do not expose the aircraft to environments that contain fine metallic particles or any other substances that may lead to electric short circuits.
 - 4 Do not expose the aircraft to corrosive environments.
 - 5 Keep the aircraft away from heat sources, combustible gases, and liquids.
-

Charging and Power

- 1 Do not leave the batteries unattended while charging. Do not charge the batteries overnight.
 - 2 Stop charging the batteries once they are fully charged. Do not overcharge the batteries.
 - 3 Always charge the batteries in a well ventilated area. Do not place the batteries under pillows, blankets, fabrics, or other flammable materials while charging.
 - 4 If you will not be using the aircraft for an extended period, the battery should be discharged to approximately 50% charge before storage.
-

Acceptable Use Policy

A user of the product shall not, either directly or indirectly:

1. Modify, reverse-engineer, adapt, or redistribute the product;
2. Manufacture, assemble, disassemble, sell, export, or supply the product;
3. Allow the product to be operated or maintained by unauthorised personnel;
4. Use the product for any purpose other than in accordance with your regulatory permit, including renting, selling, leasing or directly or indirectly charging others for the use of the product;
5. Remove, circumvent, impair, bypass, disable or otherwise interfere with any feature of the product;
6. Misrepresent or make false or misleading claims regarding the product;
7. Use the product for any illegal activity, unlawful purpose, or purposes prohibited by these Terms or in breach of these Terms;
8. Use any device, software, exploits, or routine, including any virus (e.g. Trojan horse, worm, time bomb, or any other methods not specifically mentioned herein) intended to damage or interfere with the proper operation of the product or to intercept or expropriate any data from the product;
9. Use the product in any manner that could damage, disrupt, disable, overburden, or impair the operation of the product or interfere with any person's use of the product;
10. use the product to acquire, access, or process data not intended for you.

In applicable jurisdictions, you are to ensure that any tracking devices required by regulatory authorities for UAS Traffic Management (UTM) are adequately secured to the aircraft before the conduct of each flight.

In the unfortunate event that your UAS is involved in any accident, loss, or theft, promptly report the details of the incident to support@garuda.io.

Compliance

Please refer to <https://garuda.io/regulatory-compliance/> for legal compliance requirements depending on where you fly the aircraft.

Appendices

Preflight Checklist Samples

You may use these pre-flight checklists as a starting point for creating your own pre-flight operational procedures. You should ensure that all crew members receive the necessary training before using any checklists.



WARNING

These checklists are presented primarily for illustrative purposes and are not intended to be comprehensive or customised to your specific context. Please see the 'Before You Fly' section for further information.

Date: _____
 Deployment Identifier: _____
 Battery Identifier: _____
 Capacity used: _____ mAh

Flight Engineer Checklist				
Group	Description		Checked By	Verified By
Setup	Telemetry Connectivity	Check		
	GCS Battery Level	Check		
Failsafe settings	RC Failsafe (1.RTL / 2.Land / 3.Carry on Mission)	Verify 1 / 2 / 3		
	Low Battery Failsafe (1.RTL / 2. Land)	Verify 1 / 2		
	Low Voltage and Capacity	Verify _____ V _____ mAh		
GeoFence settings	Pre-arming checks set to "1"	Check		
	Geofence enabled	Check		
	GeoFence Type (Any combination) (1.Altitude & Circle 2. Polygon)	Verify 1 / 2		
	Max Altitude	Verify _____ m		
	RTL Altitude	Verify _____ m		
	Max Radius; or GeoFence Polygon written	Verify _____ m		
	Action (1. RTL or Land / 2. Report Only)	Verify 1 / 2		
Telemetry Data	Battery Voltage	Verify _____ V		
	Horizon/Axis	Check		
	No Error Message	Check		

RC Pilot Checklist					
Group	Description			Checked By	Verified By
Platform Checks	Physical Inspection of UA			Check	
	Cracks	Loose Parts			
	Payload			Check	
	Secured	Operational	SD-card		
	Motor Mount			Check	
	Level	Secured			
	Propellers			Check	
	Direction	Secured	No Cracks		
	Battery			Check	
	Secured	Connect	No Smoke/Smell		
	CG Check			Perform	
Handheld Controller Checks	Physical Inspection			Check	
	Cracks	Loose Parts			
	Handheld Controller Battery Level			Verify _____ V	
	Connectivity with UA			Verify	
	Flight Mode Switch Toggle			Verify	
	Trims - Neutral			Verify	

END OF DOCUMENT