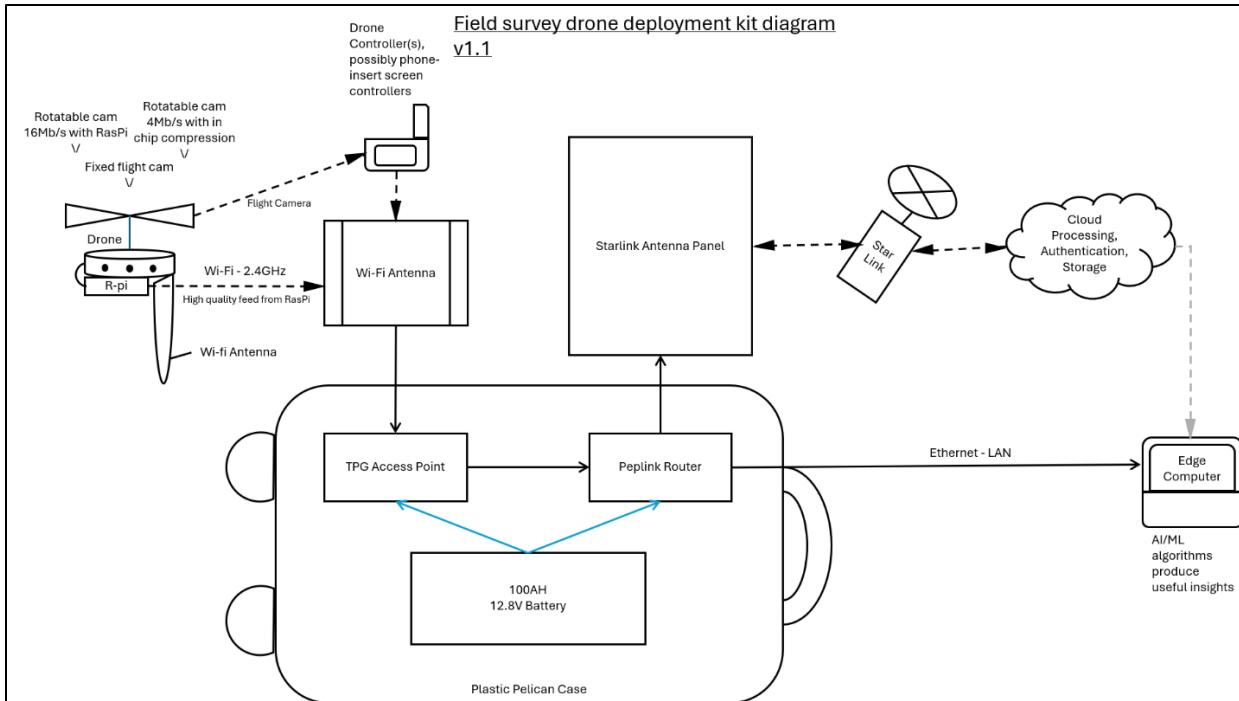


Department of Primary Industries and Regional Development – Agricultural Assistance Drone with Starlink

Created 21/01/2025, Last Edited 28/02/2025.

This document pertains to a whole agricultural technological solution including a drone connected to the internet via Starlink equipment, capable of sending imagery into AI/ML algorithms to produce valuable agricultural insights.

The Starlink equipment is provided as a rugged plastic pelican case containing all required network equipment. The user will find a removable Starlink antenna panel, a removable Wi-Fi antenna, a removable ethernet cable, a TP-Link access point, a Peplink router, and a rechargeable battery. On the exterior of the case, the user will find a mount point for the Wi-Fi antenna, a connection point for the Wi-Fi antenna cables, an ethernet port for the Peplink router (LAN/Management), an ethernet port for the Starlink antenna, various charging ports (wall-plug, inverter, solar, output), and a removable on-off switch.



The setup above includes a drone with a flight camera, a standard rotating camera, and a second rotating camera attached to a Raspberry-Pi minicomputer to handle a high-quality video feed. The drone and its camera setup may vary by use case.

The drone sends the first two feeds to the controller over a private DJI network, then to the local (Pelican case) Wi-Fi antenna, while the third camera's feed is sent over a wi-fi antenna connected to the computer on the drone to the local (Pelican case) antenna.

This data is sent from the antenna to a TP-Link access point, to a Peplink router, then over an ethernet-connected Starlink antenna to the cloud for storage/security features, and to an ethernet-connected edge computer that may provide insights based on AI/ML algorithms.

The Wi-Fi antenna, Starlink dish, router, AP, and battery for all this equipment are all stored in a pelican case for easy transport, with room for extras like a Wi-Fi extender or power cord extension. The drone and its controller have their case, and another case contains batteries for those pieces of equipment.

Contents

Page 4 – Setup Pelican Case with Starlink

Page 7 – Pelican Case Power Monitoring

Page 9 – TP Link Configurations

Page 12 – Peplink Configurations

Page 13 – Drone Setup

Page 18 – AVCRM Software (Manager)

Page 31 – AVCRM Software (User)

Page 34 – Pivotel Pulsar

Page 36 - Troubleshooting

Page 38 – Appendix A (Indicative Performance Data)

Page 39 – Appendix B (Wi-Fi Extender)

Setup Manual for Pelican Case Equipment Starlink Connection

1. Carry the case to the desired deployment location using the extendable handle, wheels, the short handle, and vehicular transport as required. Place the case onto its wide face so the latches point down. Open the case by undoing all 7 latches (3 on the front, 2 on each side).



2. Inside the case, there should be three removable items: A standard-size Starlink antenna dish, an ethernet cable, and a Wi-fi antenna. Remove these items from the case. If any item is missing, contact the party that provided the case.
3. Close the case and redo all latches. Tuck in the handle on the small face to the left, then rotate the case to sit on this face so that the small face to the right with

the antenna mounting pole is facing upwards. Slide the Wi-fi antenna onto the mounting pole and connect it to the access point via thin cables on the side of the case. Screw the cables into the antenna as tightly as reasonable with only your fingers.



4. Connect one end of the ethernet cable to the port on the back of the Starlink antenna panel. Place the Starlink antenna panel in an open area with a clear sky view, pointing South if possible. Connect the other end of the ethernet cable to the port labelled “Starlink” on the right of the upstanding case.



5. Activate the equipment by turning the red switch on the right side of the upstanding case from “OFF” to “ON.” If the red switch is missing, it may have been removed for security reasons by previously changing it to “OUT”. Contact the party that provided the case.



Pelican Case Power Monitor (100 A.h battery only)

1. The Starlink equipment is powered by a Bluetooth smart battery that users can connect to via a companion app. Download “iTechworld Connect” from the Apple or Google Play store for free.

[Search](#)



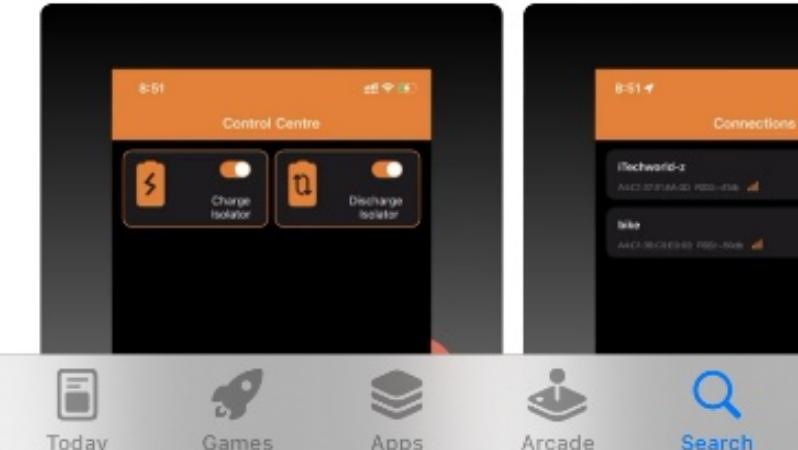
iTechworld Connect
Utilities

[Open](#) [Share](#)

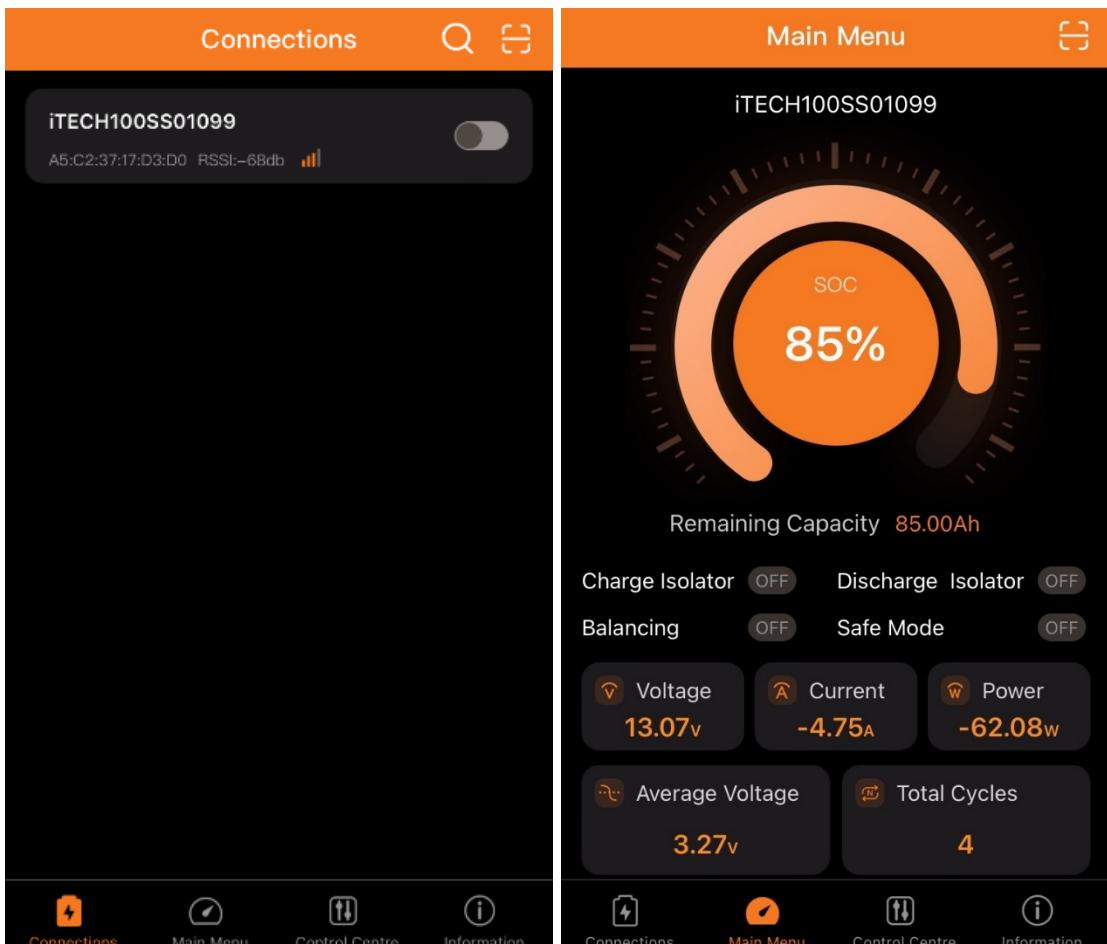
5 RATING	AGE	CATEGORY	...
2.2	4+ Years Old	Utilities	ITECH
★★★★★			

What's New
Version 1.6 8mo ago
1.Fixed some issues.

Preview



- Open the app. A battery should be visible in the list if you have connected to it before or if it is a currently available connection. Connect by pressing on the toggle switch for the battery. **Note: Only one user connection at a time.**



State of charge (SOC), Voltage (total and average per cell), Amps, Watts, and current charging status will appear on the screen to indicate whether the equipment is correctly drawing power, and how urgent it is to charge the equipment. The state of charge is rounded to 5%. “Status” may change with delays.

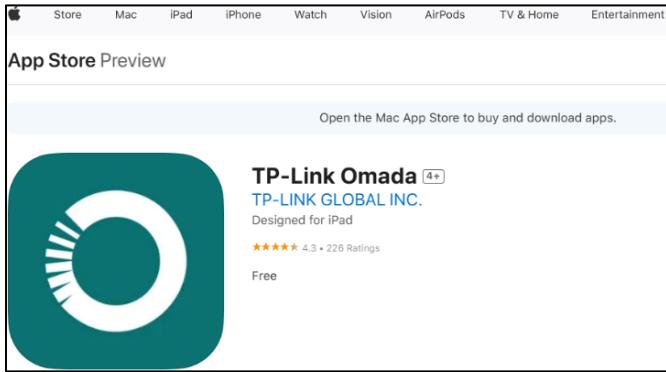
The following table contains average values from 10 measurements taken 15 minutes apart while all elements of the pelican case (Starlink data transfer, Wi-Fi and wired users) were active:

Voltage	Current	Wattage
13.07V	-5.1A	-66.69

TP Link Access Point Configuration

Note: Users that require access to the management of the TP-Link access point will require an administrator to send an invite link, then the user must log in with their TP-Link profile.

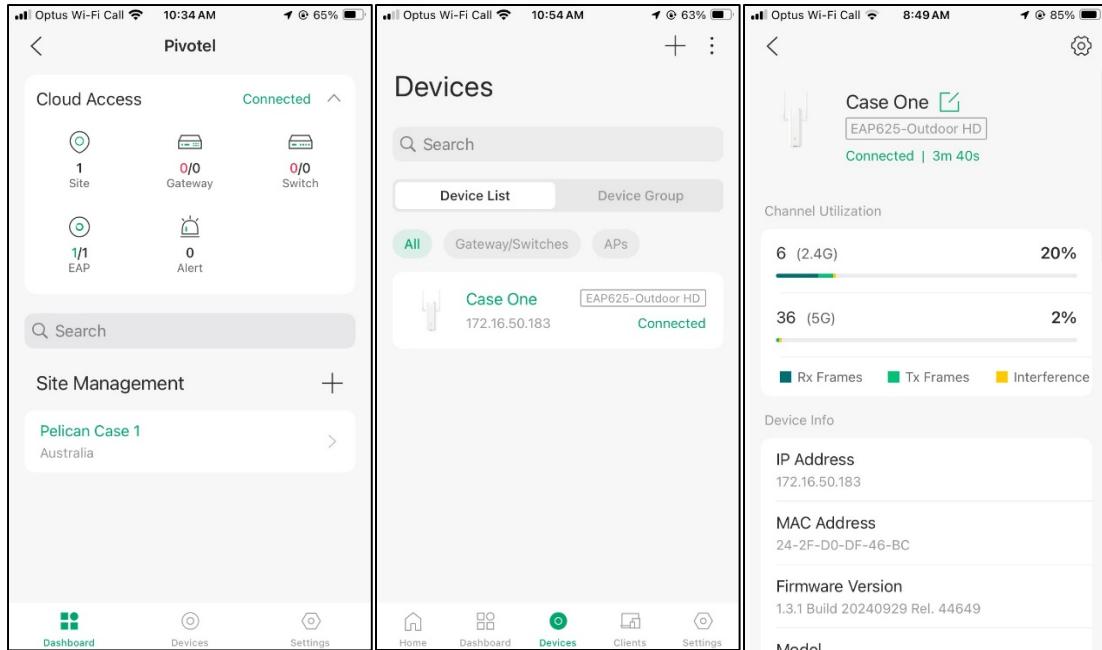
The TP-Link access point powers the Wi-Fi. Users can manage and view live data from the TP-Link access point using the “TP-Link Omada” mobile app, which can be downloaded from the Apple App Store, or the Google Play Store for free.



Open the app, tap on the “Pivotel” controller, and then tap on the desired pelican case. The prototype is listed in the first screenshot below.

Tap on the “Devices” tab to see the access point.

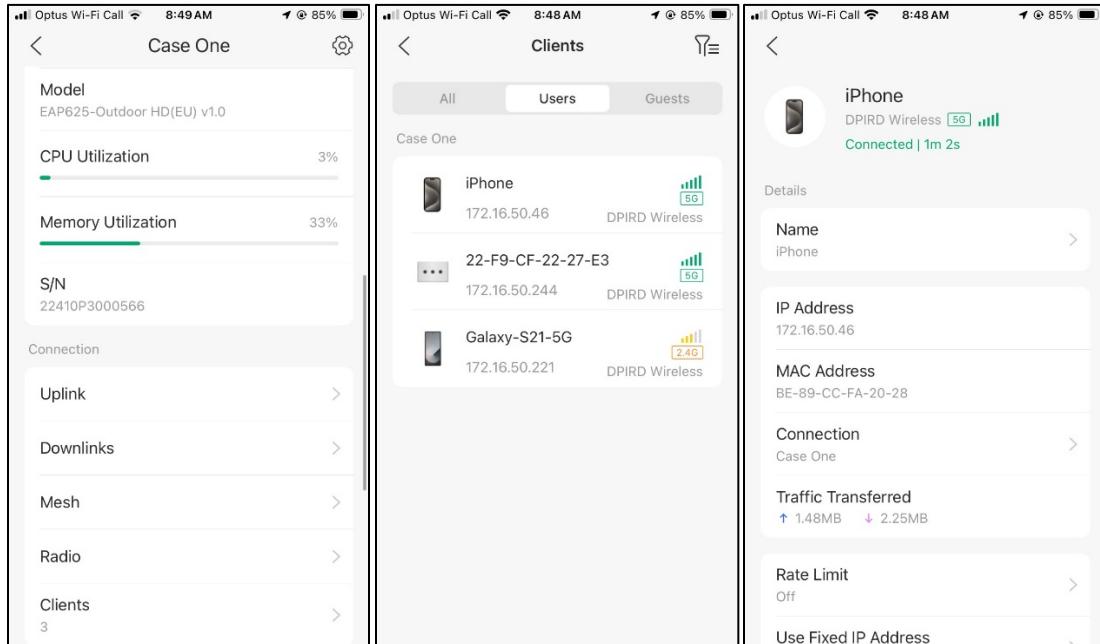
Tap on the access point for further details such as the MAC address, firmware, CPU and memory utilisation.



In the list of options for the access point, select “Clients” near the bottom to view connected devices and their data usage.

The second screenshot below shows two iPhones, and a Samsung Galaxy connected to the access point. Tap a device to access additional information.

The third screenshot below shows an iPhone’s connection time, Wi-Fi band, IP, MAC, and traffic usage.



The “Use Fixed IP Address” option in the final screenshot may be used to fix an IP address for a particular device (IP addresses are currently given out by router DHCP service).

Extended Manual

The Omada controller manual is 400 pages long and covers an extended variety of features, some dependent on particular hardware or regional availability.



Omada SDN
Software Controller 4.

Access Point Details

Configuration Parameter	Value
SSID	DPIRD Wireless
2.4 GHz Band	Enabled
5 GHz Band	Enabled
Authentication	WPA2
Encryption	AES

Peplink Router Configuration

The Peplink router is the DHCP server for the WLAN. The following table provides the network details:

DHCP Configuration	
Subnet	172.16.50.0
Mask	255.255.255.0
Gateway	172.16.50.1
DNS	172.16.50.1

The Peplink MAX Transit Pro E uses a Starlink WAN connection with a dynamically assigned IP address. The cellular WAN interfaces have been disabled.

The dedicated Wi-Fi radios have been disabled on the Peplink MAX Transit Pro E. Instead, the TP-Link access point provides coverage and access to the WLAN.

Setup Manual for Drone

1. Lift the case onto an accessible, flat surface using the handles. Open the case by undoing each pair of latches along the front and sides of the case.
2. Take both drone leg pieces out of their holes in the top part of the case and attach them to the drone by sliding them into the exposed slots, then sliding each sheath over the connection point and locking it in place by matching up the red line shown in the picture below. Lightly pull on the legs to ensure they are correctly locked in place. Place the drone upright on its legs outside of the case.



3. Carefully remove the foam blocks from the sides of the drone, sliding blades out of their slots in the foam block as necessary.
4. Move the propeller arms outwards, carefully sliding them over each other to get them all pointed away from the centre of the drone. Lock propeller arms in place

by sliding the sheath over connection point and locking it in place by turning it in the direction indicated by the painted arrows. Lightly tug on arms to ensure they are locked in place. Slide the propeller blades around so that they face opposite each other.



5. Slide in two fully charged large batteries from the battery case, attaching their electrical connection points to the connection points inside the drone's large cavities on the side. Lock them in place with a switch on the rear and ensure the batteries do not move when touched.



6. Click any cameras necessary for the current deployment onto rotating camera holders on the bottom of the drone. Ensure the camera that requires a high-

quality video feed is attached to the side of the minicomputer USB connection and connect it. The rotating camera mount shown in front of drone legs with the camera.



In the picture below, the second rotating camera is not attached, and the minicomputer is absent. The setup should otherwise look like this.



7. Remove the controller from the drone case and slide in a fully charged small battery from the battery case, ensuring the connection points match.
8. Start up both devices (Drone & Controller) with a quick press of the power button followed by a long (3 seconds) press.
9. Do a pre-flight check of the controller to ensure that settings match your current deployment requirements, and the controller is connected to the local Wi-fi. Close the check screen to view cameras, ensure that the GPS and both camera feeds are functioning, and ensure that the rotation control (wheels on the top of the controller) for the mounted camera works.

10. If unsure how to fly the drone, ask an experienced pilot to provide guidance.
Ensure the drone is in a flat, wide, open space with no humans or objects at risk of contacting the blades and hold both control sticks down to take off for flight.

11. After completing your objective, move the drone down towards a flat, unobstructed surface; do not touch the tilt controls (right stick). The drone will automatically begin a landing sequence when close to the ground. Turn the drone and controller off with the same tap, then hold the power button that was used to turn them on.

AVCRM Software User Manual - Manager

Initial Setup

1. Download and install the RPA Manager App
2. Launch the application.
3. Select the “Connect Account” button.
4. You will be prompted to either “Login via QR Code” or “Login Via AVCRM URL.
 - a. To login with the QR code, open up your RPA Manager web application and navigate to the Right-Hand Menu -> My Profile. Scroll down to the bottom of the page and scan the relevant QR code for your device.
 - b. To login with your AVCRM URL, enter the unique subdomain for your application (XXX.rpa.avcrm.net).
5. You must then provide your login credentials for your RPA Manager application.
Note: the native app requires your full ***email address*** as the username.
6. Once completed, this will be logged into the system.

Running a Job in the App

Currently, the native application doesn't have job creation capabilities (this will be available in a future release). The job submission and approval process will need to be performed via the Web Application as you currently do. There is now a requirement to assign a “Job Admin” in the job details. This is the pilot or support crew responsible for actioning the start and finish job process in the field (Managed Job). All other pilots and crew on the job will be able to view all information but cannot start or finish (View Only). This mitigates data corruption issues when it's time to sync back to the server.

Internal Job Reference	<input type="text"/>
Pilots	<input type="text"/>
Job Admin	<input type="text"/>
Flight Schedule	<input type="text"/>
RPA	<input type="text"/>

Once approved, the job will appear in the native application when connectivity is present. The App can be used on or offline, but download the job to the device when expecting no or low connectivity in the field.

Job Review Function

The Review function is a new feature that allows an organization to enforce a review phase before starting the job. This forces a pilot to view some or all sections of a job before starting. This process is described in the job workflow below but is not required and is configurable from the web application. To customize or remove the review process, navigate to Right Menu -> RPA Jobs and select (or deselect) the sections you wish to enforce as shown below.

Required Native Sections

Selecting sections here enforces pilots to review the corresponding section in the native app during the job workflow process.

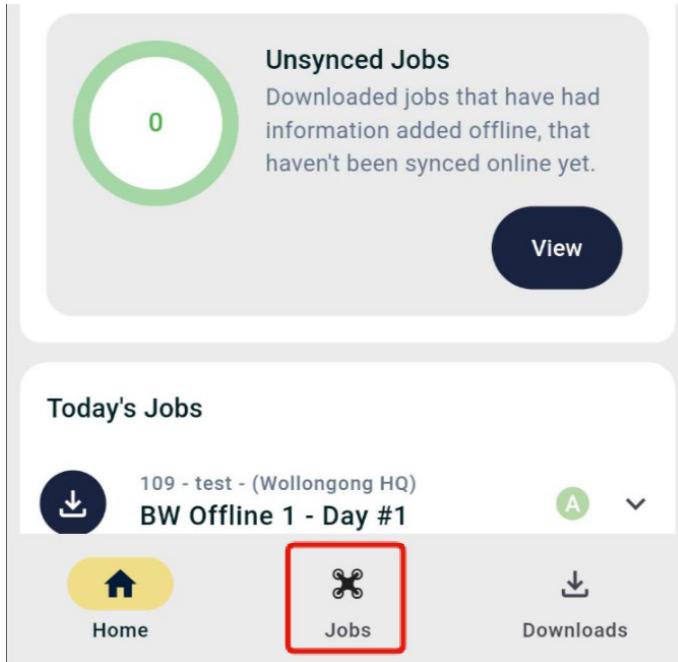
Job Details
Job Area Overview
Job Risk
JSA
Job Attachments
Job Sign Off

Save Changes

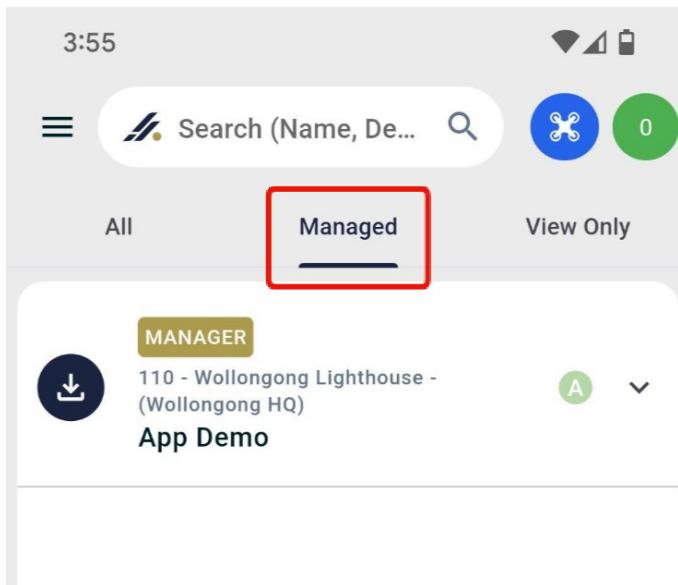
Manage your Job Restriction rule sets to prevent submission when Jobs match conditions.

Start Job

On the main page of the native application, select “Jobs” in the bottom toolbar.



To view jobs that you have been assigned as the “Job Admin”, select the “Managed” tab.



Select the relevant job to bring up further details, and then select “Review” to start the job in the system.

MANAGER
110 - Wollongong Lighthouse -
(Wollongong HQ)

App Demo

Your Role	Status	Type
MANAGER	APPROVED	OPS

Multiday Job # Start Date
NO 0000110 30/08/2024 08:00 AEST

RPA Identifiers Pilots
m3P - Angel Tyler Heycott

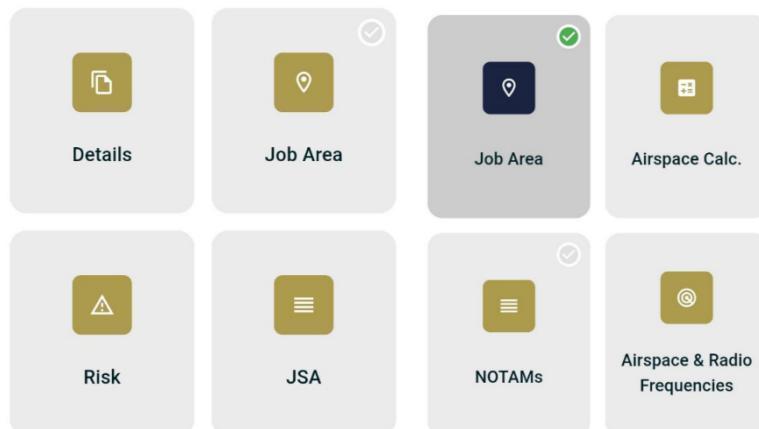
Location Client
Wollongong Lighthouse N/A

Base
Wollongong HQ

View **Cancel**

Review

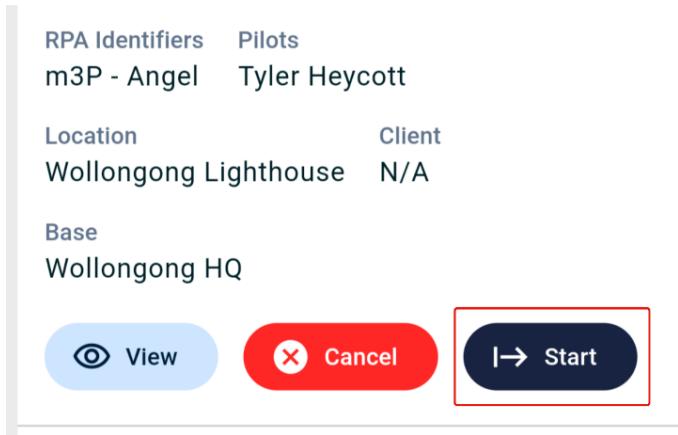
This will provide the details for the job broken down into individual sections. These can be reviewed by selecting the relevant item to review. If an item requires review, it will show a white tick icon, which will change to a green tick once the section has been reviewed.



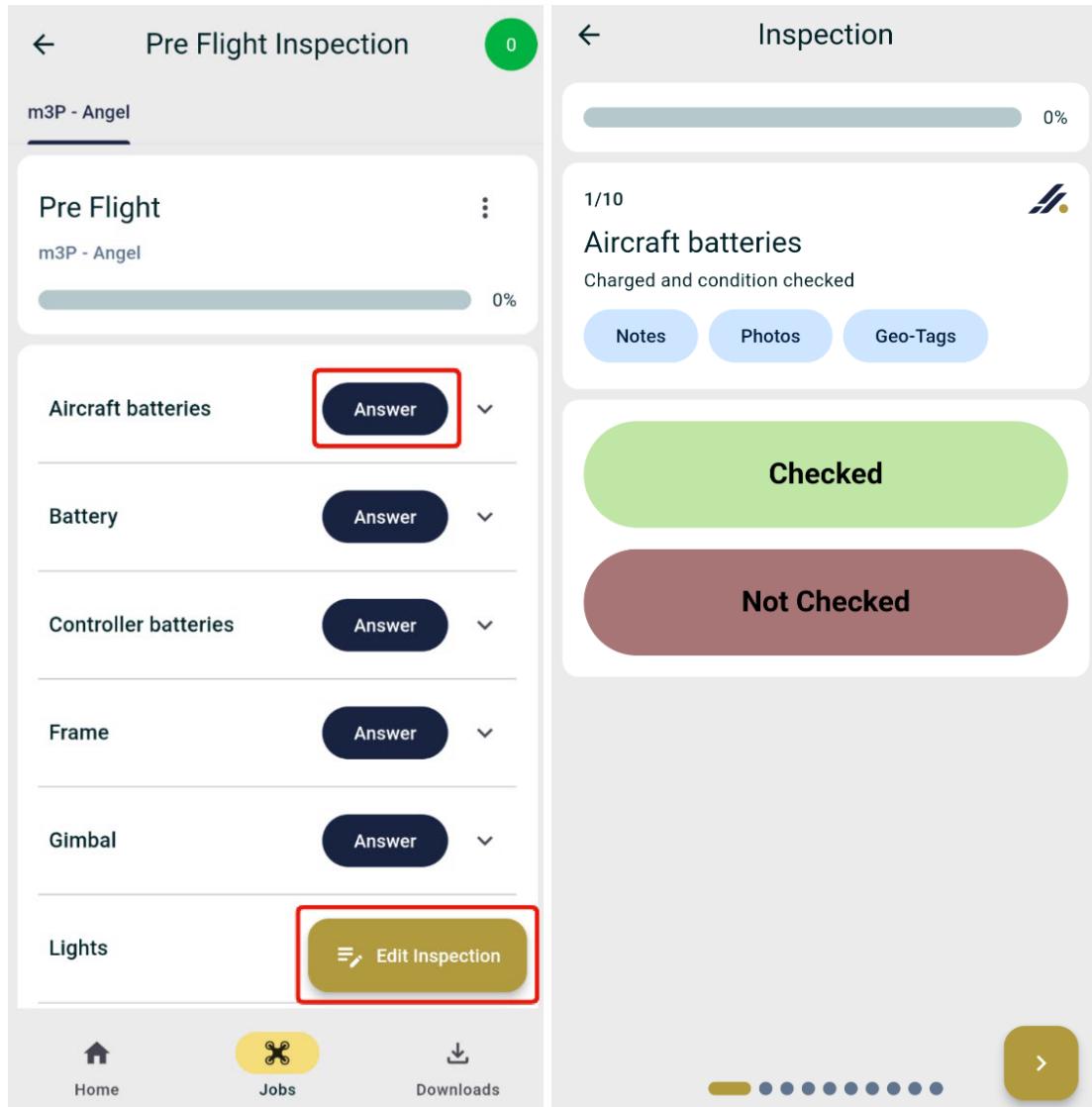
Once the review process is completed, you will see a dialogue confirming the job has been reviewed. This will then take you back to the “Manage” page.



Next, select the “Start” button.

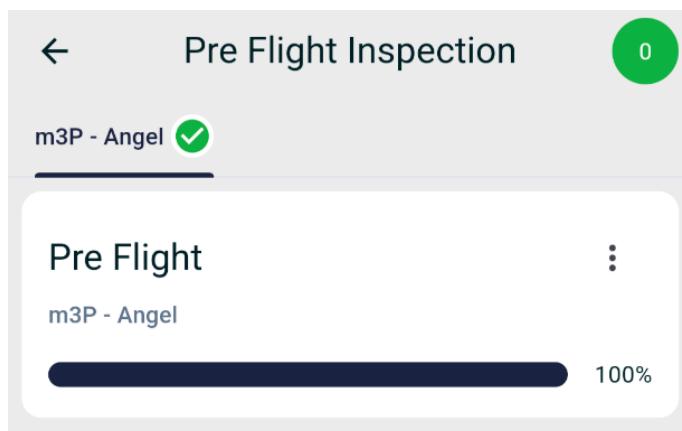


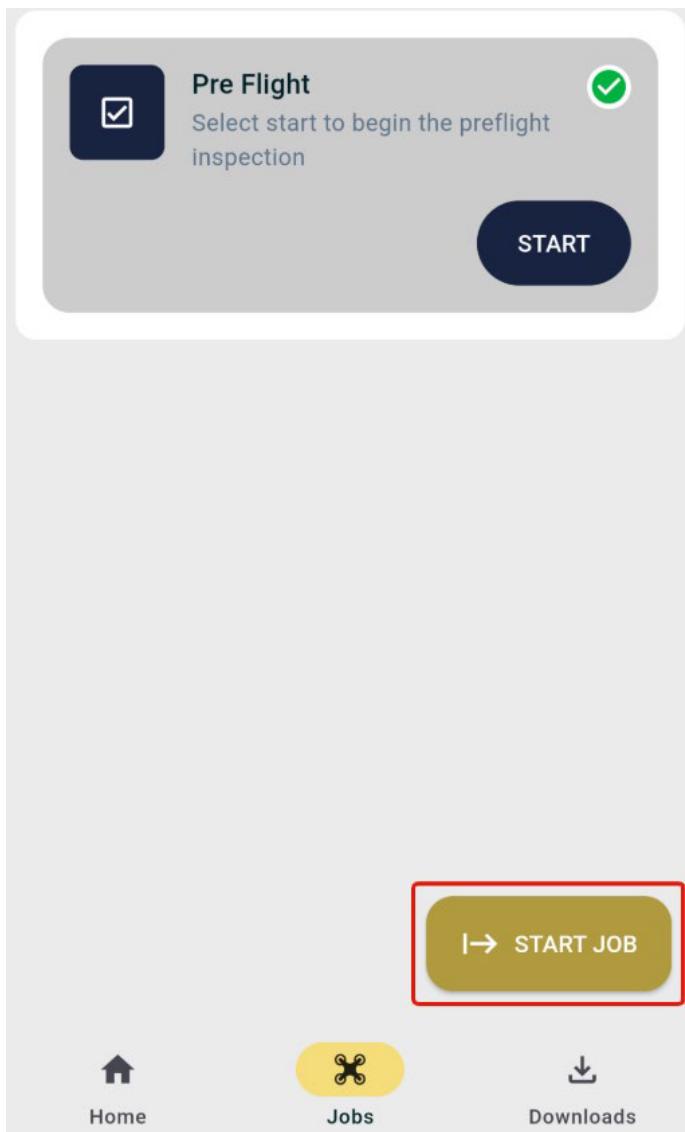
This will open the Pre-Flight Checklist. You can respond by selecting “Answer” or “Edit Inspection” to respond to each item. You can add additional information per item by choosing “Notes”, Photos”, or “Geo-Tags” to bring up the relevant data entry pop-up.



Once completed, select the “Finish” button. This completes the Pre-Flight checklist.

Select the back arrow at the top of the page and then select “Start Job”.





You will then be presented with a confirmation box. Select “Continue” to proceed.

This will then put the job into a running status.

Finish Job

1. If you have just completed the above steps, you will be automatically taken to the Finish Job page. If you are returning to the app later, access the Finish job process by navigating to your “Managed” jobs and then selecting the “Finish” button.
2. From this page, you have the following options:
 - a. **Flights:** This is where flight records can be added to a job. Select the “Flights” box and then either select the +

button to manually add flights or the  button to use “Flight Data Sync”. Note: to use flight data sync, you will have to be online.

- b. **Post Flight:** Select the “Post Flight” box and then proceed with the checklist in the same manner as the Pre-Flight Checklist detailed previously.
- c. **Defects:** This constitutes the defect portion of the Finish job process. Select the “Defect” box and then “Add Defect” to enter information.
3. Once all the above sections have been completed, you can select “Finish Job” to complete the job process.

Download Functions

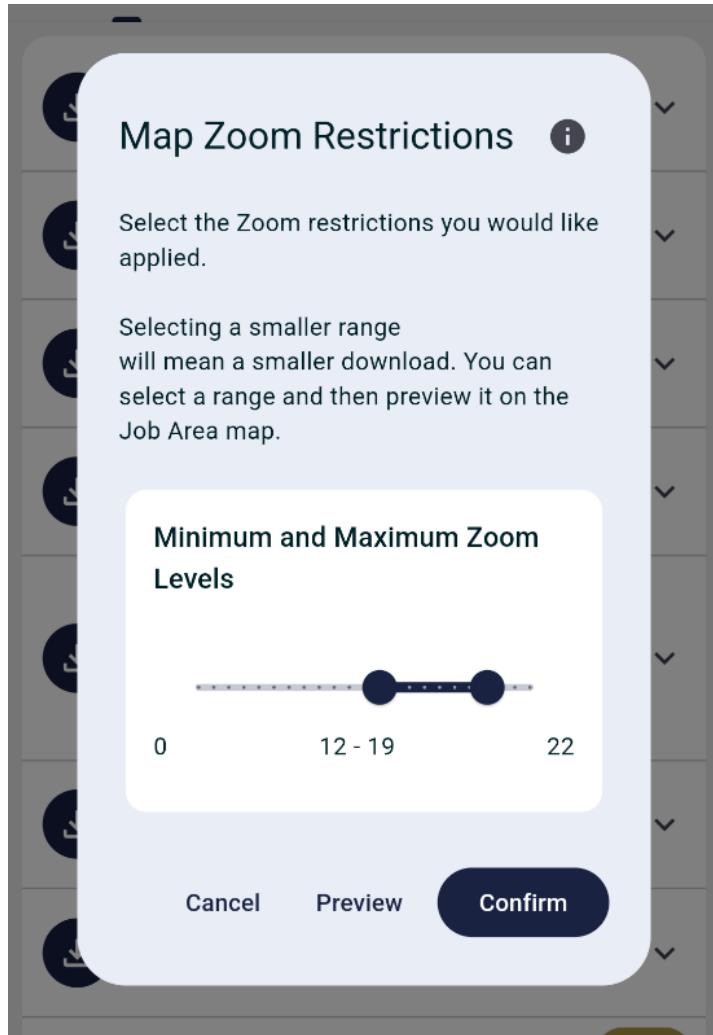
Downloading Jobs

One of the key functionalities of the native app is the ability to download jobs to your device for offline access. Use the following steps to download jobs to your device:

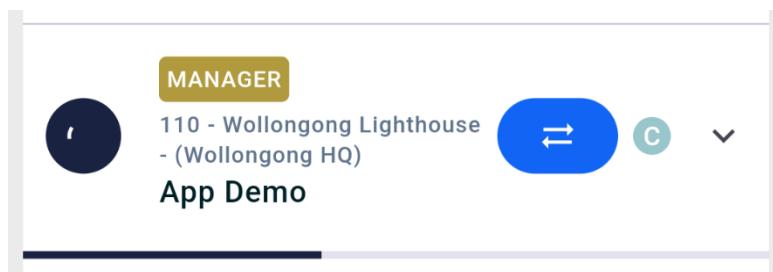
1. Select the “Jobs” tab on the bottom toolbar or from the Left-Hand Menu.
2. Select the download icon for the job you wish to download.



This will then open a pop-up screen regarding the “Map Zoom Restrictions”. This will determine the level of clarity provided for the map data in the downloaded job. Drag the sliders to the desired level and select “Preview” to view the level of detail that will be provided. Once complete, select “Confirm”.



This will then begin the download process. You will see a progress bar running across the bottom of the job details. Once completed, the job will show a green tick to confirm it's been downloaded to the device.





Auto Download Jobs

The system can auto-download jobs to your device to ensure job information is available in the field as required. To turn this on, open the Left-Hand Menu (☰ in the top left-hand corner) and select “Manage Downloads”. From here, select the “Settings” tab and under “Auto Download Jobs” select “Turn on”.

Managing Downloads

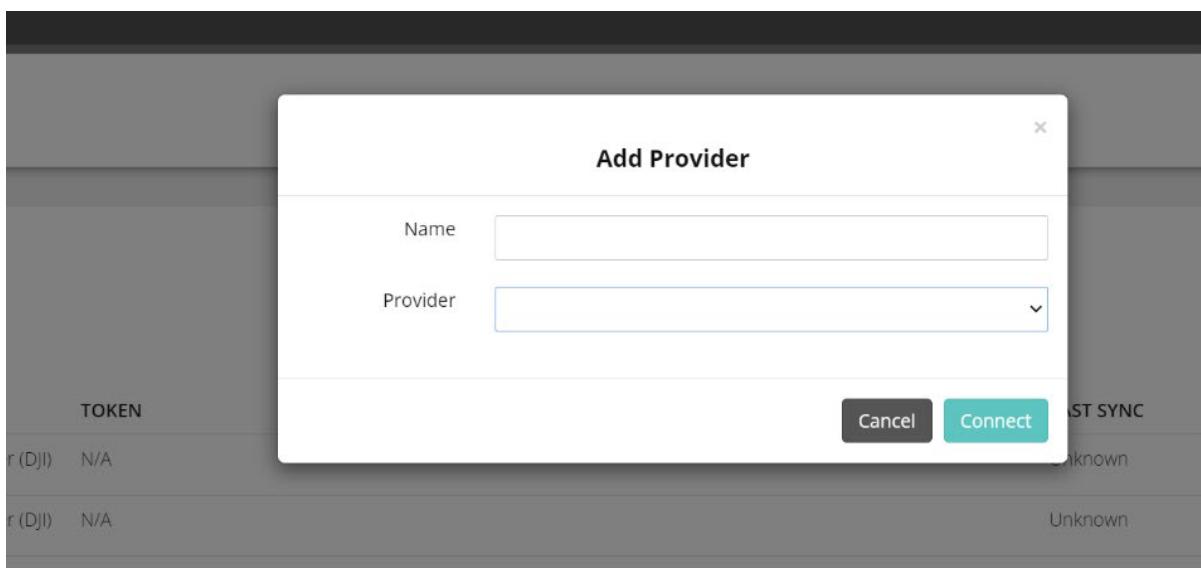
To manage all downloaded jobs, navigate to the “Downloads” tab in the bottom menu. All downloaded jobs will appear on this page. Select the vertical ellipses (⋮) on the relevant job to either re-download the job or delete the download off your device.

Syncing Functionality

The native application can automatically sync flight records directly from the controller or device operating the DJI applications. **THIS IS ONLY AVAILABLE FOR ANDROID.**

In the Web

Before this function works, you must add the RPA Manager App as a connected provider in Flight Data Sync.

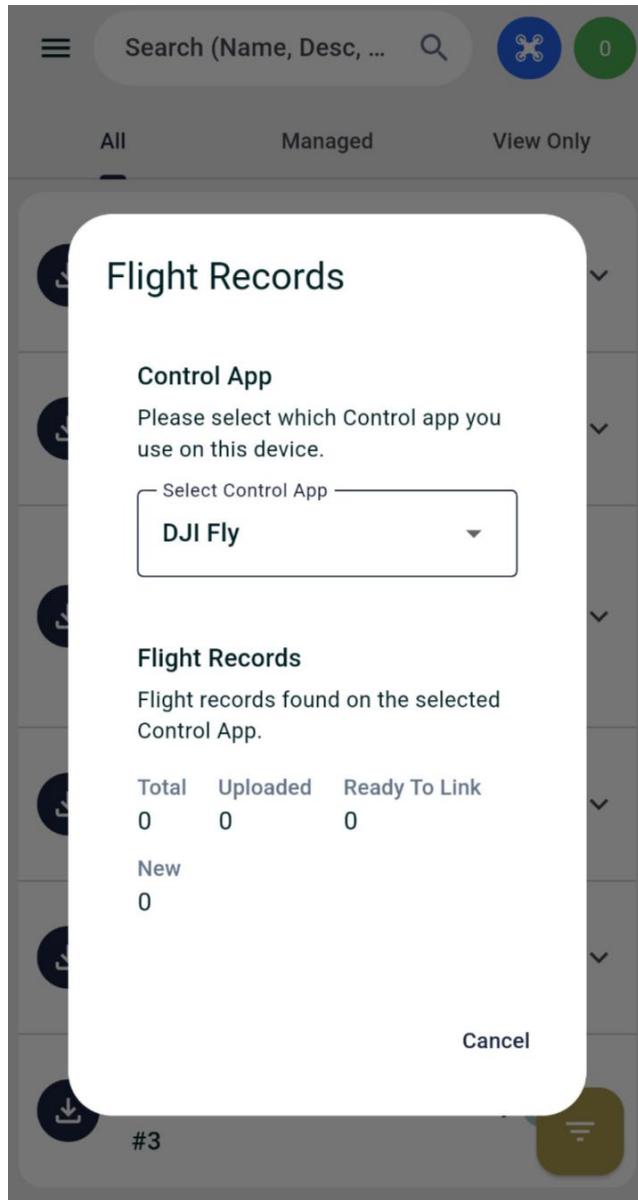


You only need to add this once, regardless of how many pilots use the RPA Manager App to sync records. It is important NOT to have your DJI Cloud account connected simultaneously, or you will receive duplicate records. Turn off the associated DJI Connected Provider or do not sync your records to the DJI Cloud on the controller.

In the App

To utilize this functionality, please use the following instructions:

1. Within the application, select the Quadcopter icon at the top of the page
2. Select which DJI application was used to control the aircraft. The system should automatically scan for any currently installed and provide them in a dropdown list.
3. If it is your first time doing this, it may require confirmation of where these flight records are stored. Please contact our support team if you need assistance with this.
4. The system will then pull through the flight records into your application.



In the Manage Downloads section (settings) you can configure the application manually or auto-sync. When set to auto, the RPA Manager application, when running (in the background) will look for new record creation and sync new records to the AVCRM server for processing.

Installing the Native Application on DJI RC Pro/Plus

For DJI controllers with an inbuilt screen, you can download the AVCRM native application and automatically sync your flight records directly from the controller to your RPA Manager application. Due to permissions issues, the Play Store will not run on DJI devices. Alternatively, we will utilize the Amazon App Store to download the application. The steps are as follows:

1. On your GCS, open the internet browser and either search for “Amazon App Store” or use the following URL: <https://www.amazon.com/gp/mas/get/amazonapp>

2. Select the “Get Amazon Appstore” button.

This may prompt your controller to require permission to save files from the browser^[5], select the allow button if this appears. a. You may also see a prompt stating that the browser is not able to install application files. To remedy this, you should allow permission for the internet browser or file manager to install apps. To manually turn this on, select *Settings -> Apps & Notifications -> Select relevant app -> Scroll down to “Advanced” -> Select “Install Unknown Apps” -> Select Toggle Switch.*

4. Once installed, open the “Amazon Appstore” app.

5. Provide your Amazon login credentials or create an account as required.

6. Once logged in, select the search bar at the top of the page.

7. Search for “AVCRM” and select “Get” once the RPA Manager appears. a. You may need to allow the Amazon Appstore to Install unknown apps. You will see a pop-up at this stage running you through how to complete this.

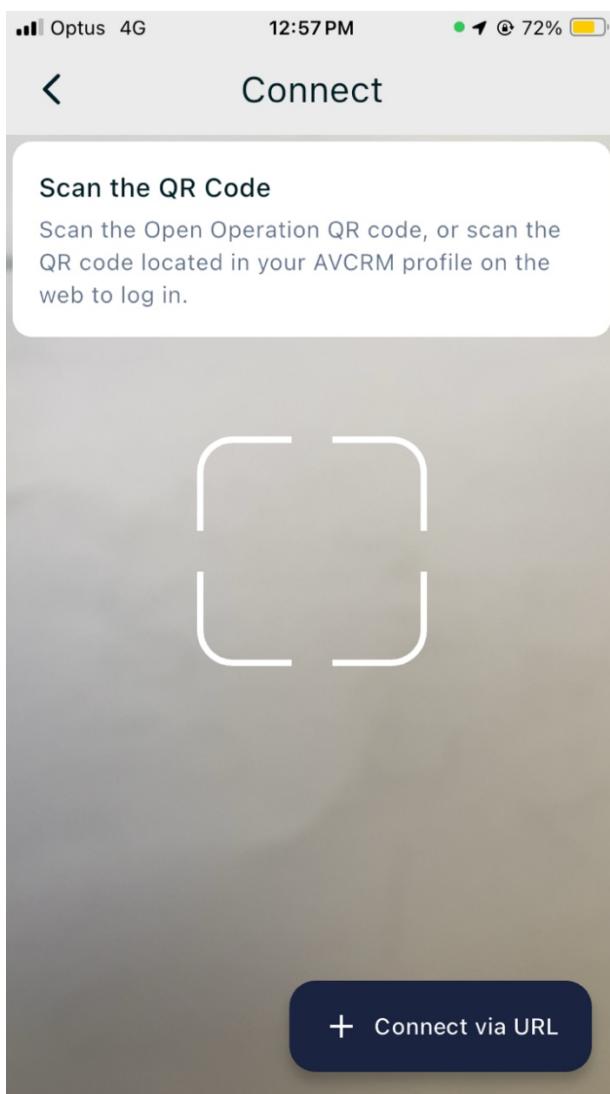
8. Once downloaded, select “Install”.

9. You have now successfully downloaded the app onto your controller.

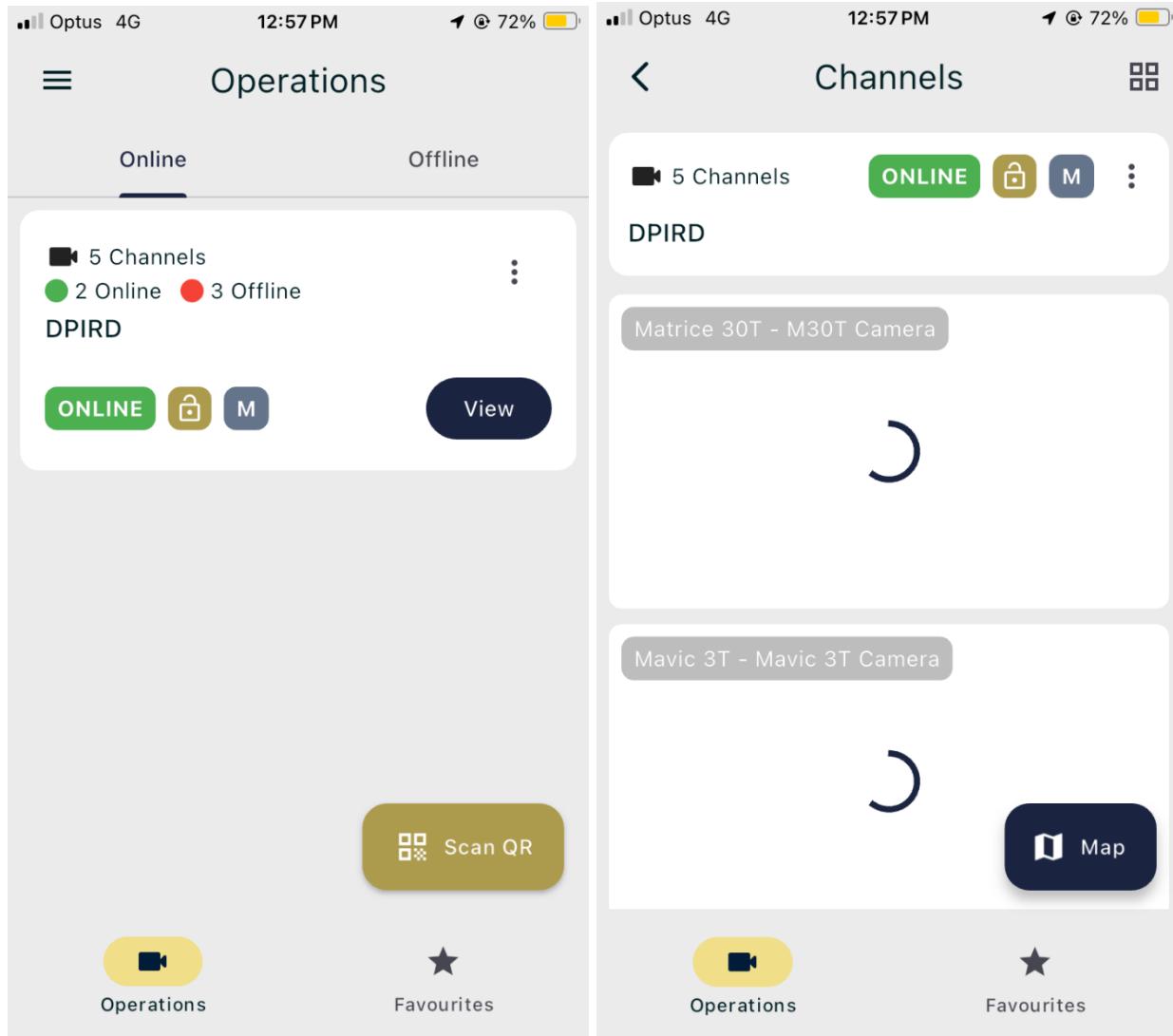
AVCRM Software User Manual – User

Download and install the AVCRM Live app on your smartphone. Opening the app, it will activate the camera and prompt you to scan a QR code.

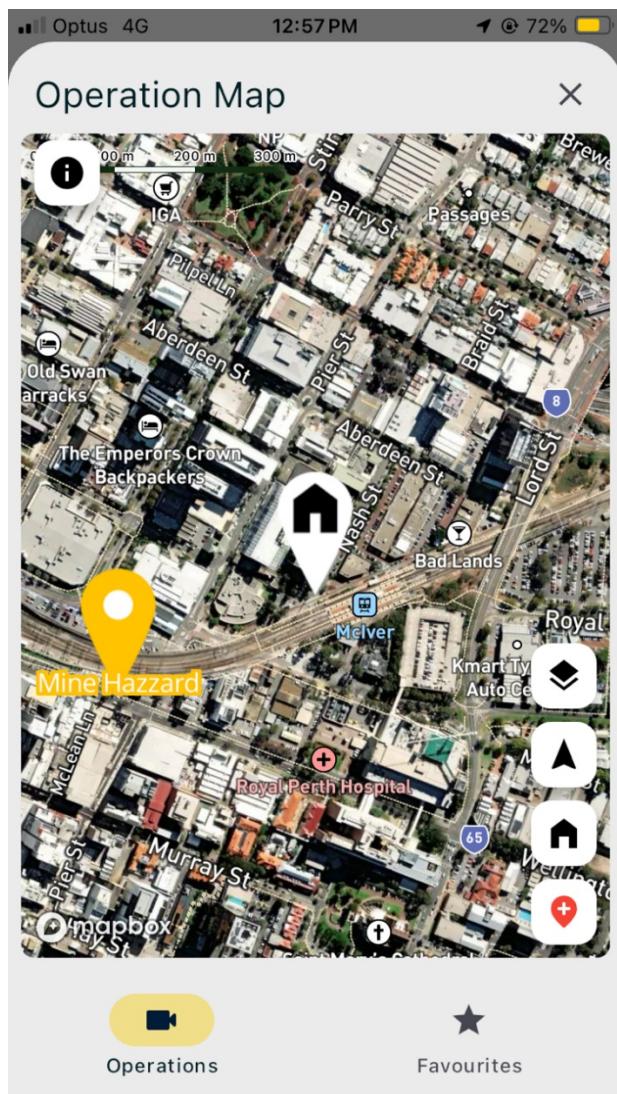
Scan the QR code provided by the AVCRM manager who began an operation, then input the PIN codes they provided. The QR and PIN code will often be found on a PDF or printout generated when an operation is created.



You can now select the operation and view the existing channels (drone camera feeds) in a list or open the overhead map with the button at the bottom right.



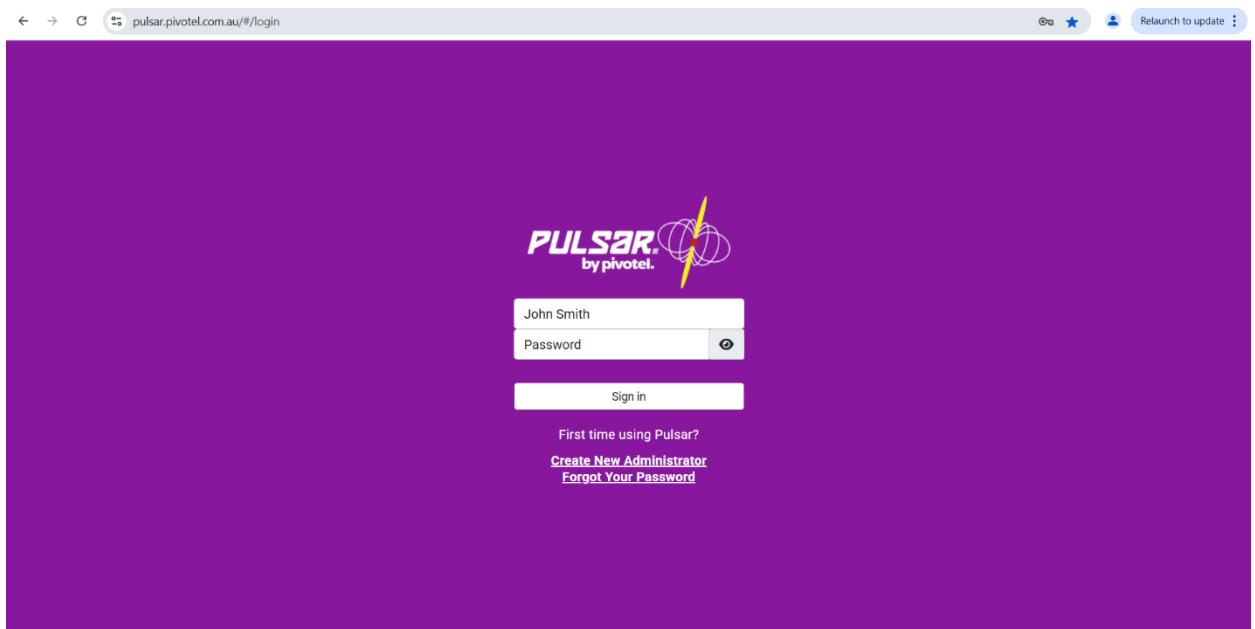
The map shows your location, the origin of the operation, and any locations you and other users added. The button in the bottom right can add a location. A manager must publish it so that it becomes visible on the flight controllers.



Pivotel Pulsar

If you are working with Pivotel on this project, you may have the opportunity to view a data presentation platform called “Pulsar”, for debugging or reporting purposes.

1. If you have been given a Pulsar account to use, log into it:

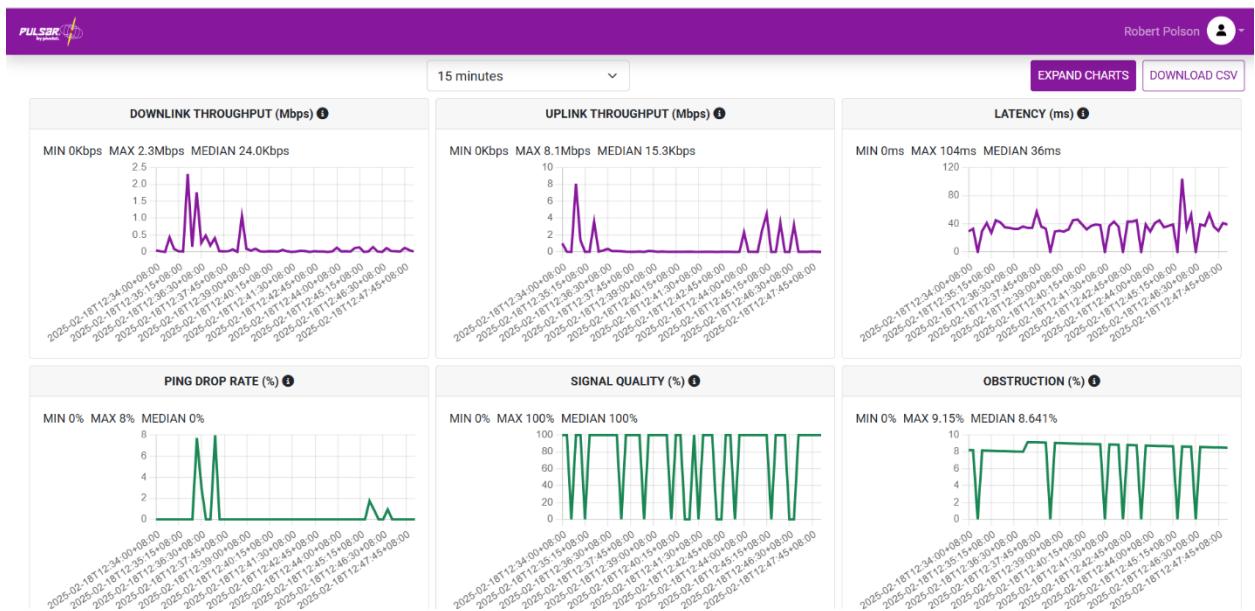


2. In the search field at the top left, type in the Department of Primary Industries and Regional Development account code “40069993” and enter. The page should display all current devices.

Name	Tags	Type	Service Number	Hardware Serial Number	Status
DPRID Pelican Case 1	Pelican Case Black	Starlink Services	3001182-67511-60	KIT400665095	OK

3. Select the device you wish to see statistics for which a page will open that scrolls down, listing technical information and showing a graph of recent data traffic Bytes. Note: As of writing this document, the radio status to the right of the device name may experience delayed changes.

4. Select the “Telemetry Info” button at the top to view advanced graphs.



Troubleshooting

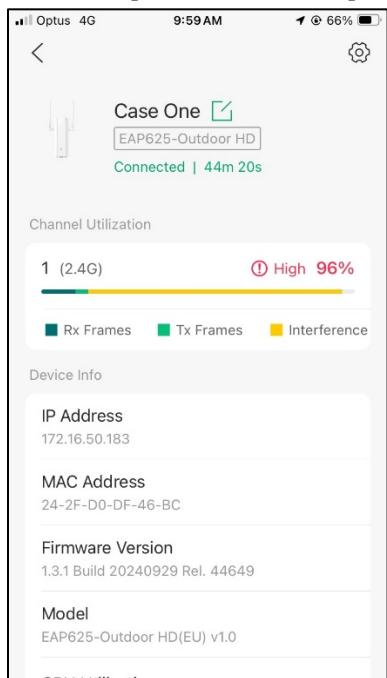
Issue 1 – Poor Wi-Fi performance

Poor Wi-Fi performance is initially identified as:

- Very poor internet speed test results for Wi-Fi connected devices near the antenna, compared to wired devices.
- Degradation or delay in media feed from connected drone while within 500m and in line of sight.
- Poor iPerf3 test results between Wi-Fi connected devices (compared to results in Appendix A)

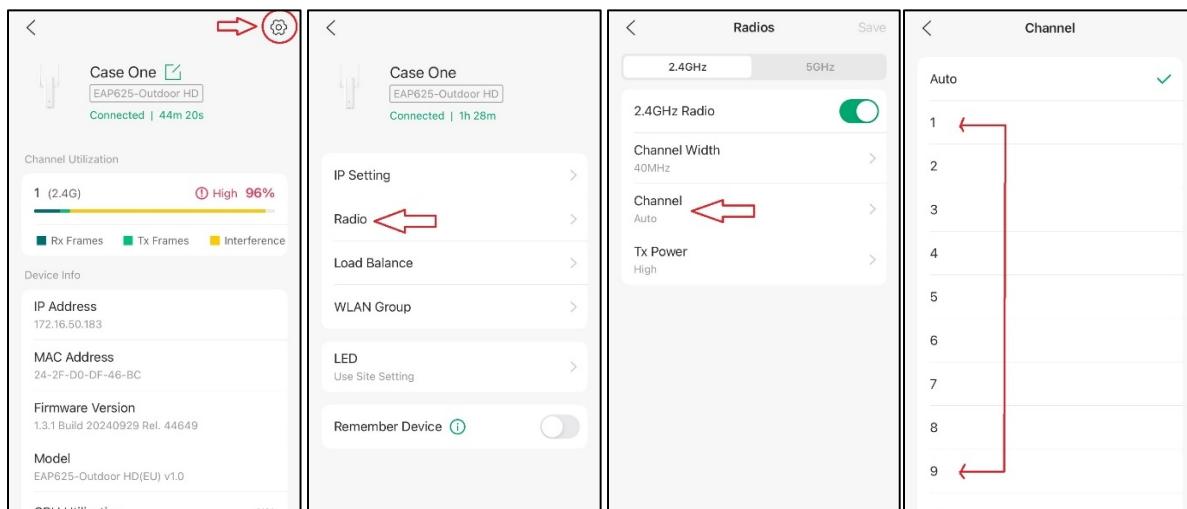
Steps to resolve:

- Ensure that the Wi-Fi antenna is securely connected to the access point in the pelican case, checking that the wires on the antenna are not loose.
- Remove causes of interference such as other active access points nearby or large metal obstructions between the antenna and your devices.
- Check TP-Link Omada management software (if available) to identify interference in Devices-[Relevant Case].



In the screenshot above, a large amount of interference is shown to be using up the 2.4GHz Wi-Fi channel. This is because the Wi-Fi channel width was set to 40MHz and placed in a building with 5 other strong signals nearby.

If there is significant interference on the bar, press the settings button on the top right of the device on TP-Link Omada, navigate to Radio settings, then change channel settings, picking a different channel and checking the interference bar until the interference is eliminated.



Appendix A – Indicative Performance Data

Wi-Fi internet speed test

Starlink internet speed over Wi-Fi was measured at varying distances from the access point (with antenna) across a large field (Showgrounds Event Field)

Phone distance from equipment	Internet speed over pelican case Wi-Fi
75 metres	201Mb/s down 30.1Mb/s up
135 metres	222Mb/s down, 19.8Mb/s up
190 metres	235Mb/s down, 13.3Mb/s up
265 metres	197Mb/s down, 27Mb/s up

*Small iPhone models may display significantly worse results due to antenna limitations

iPerf3

Data transfer speed between an edge computer (Wi-Fi connected near Starlink equipment) and a Raspberry Pi minicomputer (Wi-Fi connected, located on drone moving at varying distances) was measured using iPerf3 at Increasing distances.

Drone distance from equipment	Data transfer speed over TCP (uplink and downlink are symmetrical)
30 metres	200Mb/s
100 metres	131Mb/s
160 metres	118Mb/s
260 metres	111Mb/s

*Optimally, the edge computer would be connected over to the ethernet, improving speed. For this test, Wi-Fi was used.

*Optimally, the minicomputer would hang below the drone, with the Wi-Fi antenna pointing down, decreasing interference from the drone and its propellers. In this test, the speed was somewhat impacted by the placement of the computer atop the drone.

Appendix B – Wi-Fi Extender

A Wi-Fi range extender can be a useful tool to bend a signal around obstacles such as impeding terrain or structures, but not to send a signal through them.

Download the TP-Link Tether app if you wish to set up a new Wi-Fi extender.



Plug an extender into a socket (Extension cable, wall socket, power strip, etc.) in a location with a line of sight to the pelican case equipment, and a line of sight to the location where you require extra Wi-Fi speed. Using the app, boost the signal for the pelican case Wi-Fi, named “DPIRD Wireless”, as of this document’s last revision.

Indicative performance data was acquired while testing a TP-Link Wi-Fi 6 Extender AX1500. Internet speed over Wi-Fi was tested over both the pelican case connection and nearby Wi-Fi extender connection at two locations.

Location 1 – 150M from case. Somewhat impeded sightline to the case, good sightline to the extender.

Location 2 – 165M from the case. Behind the building, no sightline to the case, no sightline to the nearby extender.

	Pelican Case Speed	Extender Speed
Location 1	120Mb/s down, 12.2Mb/s up	146 Mb/s down, 15Mb/s up
Location 2	39.8Mb/s down, 8.51Mb/s up	62.7Mb/s down, 2.47Mb/s up

*Significant presence of multiple strong Wi-Fi signals nearby will have interfered with these results.