



# SkyHub

**Revision 4.4**

*July 2026*



Please read this user manual carefully before operating the appliance, and retain it for future reference.



To prevent damage to the components, ensure that all connections to the SkyHub device are made while the device is powered off.





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**Warning**

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**Note**

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## Release notes

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### 1.1 UgCS-CPM and SkyHub firmware v.4.4.5

#### 1.1.1 What's New in 4.4.5

1. SkyHub software using the 'SkyHub - V3' App ID for DJI M400 drones is now approved by DJI for mass production. This brings full vendor support and removes the recurring notifications about running a developer version of the software. To use the approved App ID, the DJI PSDK cable must be rebound with a new set of credentials — a quick procedure done over a video call with one of our support engineers. (Required for DJI M400 drones only.)
2. Support for multiple devices of the same type is temporarily disabled in the CPM UI. This version allows only one device per model to be configured, which prevents configuration errors. If you need to set up multiple devices of the same type (for example, several altimeters), please contact support.
3. USB adapters now use static names. The configuration of USB-connected devices and autopilots depends only on the connectors in use, so your setup stays the same even when some devices are powered off.

#### 1.1.2 Fixed in 4.4.5

1. Removing device configurations from the CPM UI now works correctly.
2. The Reconnect button in CPM is now available after a failed connection attempt.
3. Obstacle avoidance no longer activates incorrectly when the MR72 license is missing.
4. The default SBES cable length is now 2.28 m.

### 1.2 UgCS-CPM and SkyHub firmware v.4.4.4

#### 1.2.1 Fixed in 4.4.4

1. Fixed the connection loss between SkyHub and the Companion app on the DJI M400 drone.

### 1.3 UgCS-CPM and SkyHub firmware v.4.4.3

|                                                                                                   |
|---------------------------------------------------------------------------------------------------|
| <b>Warning</b> Starting from version 4.4.3, UgCS-CPM is compatible only with UgCS EXPERT and UgCS |
|---------------------------------------------------------------------------------------------------|

### 1.3.1 What's New in 4.4.3

1. Instead of using the separate Grasshopper mission type, use the additional actions: hop and drop.
2. The 1 ms configuration option has been removed from MagNIMBUS.
3. To prevent accidental actions during flight, the reboot and reset buttons are now disabled while the drone is flying.
4. The Set cable length button has been removed from the SBES widget.
5. After the factory reset, the climb speed limit will be reduced to 1 m/s as a safety precaution

### 1.3.2 Improvements in 4.4.3

1. Improved compatibility between the Zond Aero module and older sensors.
2. Improved compatibility between the Echologger module and the latest sensor firmware.
3. Improved CPM switching when multiple drones are connected.

### 1.3.3 Fixed in 4.4.3

1. Fixed the message format in Echologger NMEA files.
2. Fixed the message format in GNSS output.
3. Fixed the logged “Next WP” number before the first waypoint is reached.
4. Fixed in-flight updates of dynamic SBES parameters.

## 1.4 UgCS-CPM and SkyHub firmware v.4.4.2 HotFix

### 1.4.1 What's New in 4.4.2

1. MagNIMBUS now supports QuSpin Gen-2 sensors with the latest firmware, V1\_41.
2. Echologger now checks the sensor firmware and advises users to update older versions.
3. CPM now supports a special widget for the altimeter connected to a MAVLink drone.

### 1.4.2 Fixed in 4.4.2

1. Companion loses connection to SkyHub under high load.

## 1.5 UgCS-CPM and SkyHub firmware v.4.4.1

### 1.5.1 What's New in 4.4.1

1. DJI M400 drone support (requires new SkyHub smart cable for DJI M400)
2. Dynamic configuration of Zond Aero GPRs, Echologger SBES echo sounders, and Cerulean MBES echo sounders during flight
3. Falcon+ sensor will update zero-level on Record button press

4. Falcon+ sensor will report if no data for more than 2 seconds
5. Support for displaying a list of configured sensor instances and deleting them
6. Experimental support for Cerulean OmniScan 450 side-scan sonar
7. Data for Cerulean Surveyor 240-16 is geotagged using MBES head coordinates
8. Added the Disable Temporarily button to disable Obstacle Avoidance at any time
9. Added the Set cable length button for SBES devices to simplify configuration
10. Added support for TTF with multiple altimeters
11. CAN bus support is disabled by default for Geolux devices
12. Changed the default max wind speed limit for the anemometer module
13. Optimized the startup sequence for Falcon+
14. Embedded obstacle avoidance sensor data is logged to position.csv
15. Embedded obstacle avoidance sensors on the DJI drones can be monitored in CPM
16. Added missing GPR sample count values in the CPM UI
17. Added new parameters for Falcon+ to the configuration UI
18. Drone control is now set to speed control mode by default

### **1.5.2 Fixed in 4.4.1**

1. Fixed an issue where SBES logging fails in NMEA mode
2. Fixed the default NTP server address for MBES
3. Fixed safety check on AGL waypoints: drone will trigger safe altitude emergency action if it flies AGL below minimal altimeter range plus 2 meters or above the maximal altimeter range minus 2 meters
4. Fixed license checks: Echologger and GPR modules properly check the license availability
5. Fixed MagNIMBUS initialization to improve stability
6. Fixed RadSys GPR initialization to improve stability

## **1.6 UgCS-CPM and SkyHub firmware v.4.3.2**

### **1.6.1 Whats New in 4.3.2**

1. Added support for Laser Falcon+ methane detector.

### **1.6.2 Fixed in 4.3.2**

1. Fixed GPR connection issue.

## **1.7 UgCS-CPM and Skyhub firmware v.4.3.1**

### **1.7.1 Whats New in 4.3.1**

1. **Sensors can now be configured via the GUI:**
  - Individual payloads may be enabled/disabled with the “Payloads” section.

- Autopilot selection and configuration may be done in the “Settings” section.
- All common parameters are available for configuration in the “Settings” section with drop-down menus.
- There are dedicated widgets for all supported sensors. Every sensor instance may be configured with the “Settings” menu of the corresponding widget.
- Added the ability to configure individual widgets for multiple identical sensors.

**2. Improved driver for GPRs:**

- The device now reconnects automatically when the connection is lost.
- Added GPR transmitter cutoff when altitude is above 1 meter.

**3. Increased TTF trajectory precision for DJI drones:**

- GH/TTF mission execution uses the angle-control mode to fly the drone.
- Trajectory deviation on long lines has been reduced to 0.1-0.3 meters.

**4. Added additional diagnostic messages for altimeters used in TTF mode:**

- Altimeters’ connection/disconnection events are reported to CPM.
- Missing configuration for altimeters is reported to CPM.

**5. Added NTP server:**

- Works in conjunction with the Cerulean Surveyor module.
- May be used by third-party modules to get the UTC time correction.

**6. Improved Obstacle Avoidance subsystem:**

- Obstacle avoidance uses embedded DJI sensors (except the downward one).
- Embedded DJI sensors are enabled or disabled using the DJI Pilot application.
- Obstacle avoidance will be activated automatically if the TTF/GH mission is active or if the configured altitude/speed is reached.
- Obstacle avoidance may be configured to work with any number of altimeters or radars connected to the SkyHub.
- Default obstacle avoidance parameters have been tuned: activation speed has been changed from 0.2 m/s to 4.0 m/s.

**7. Added Laser Falcon+ methane detector support.**

**8. Added support for Cerulean Surveyor 240-16.**

**9. Improved performance of USB connections:**

- The SkyHub uses a new XHCI USB kernel module.
- Greatly improves the stability for multiple MagNIMBUS devices working together.

**10. RC lost event: the drone will perform a failsafe action in case of RC disconnection in flight:**

- The drone now performs the action configured with the DJI Pilot application for the auto mission.
- In the TTF/GH mission, the drone now performs the RC loss action configured for the mission in UgCS.
- In case of return-to-home action, the drone ascends to the failsafe altitude and then returns to the point of takeoff.

**11. Added button to reset to factory default configuration:**

- There is a new button in the Tools menu to reset all the configuration changes to the default



state.

- This reset may be performed only on the ground and only if there is a Wi-Fi connection to the SkyHub.
- After the factory reset, the SkyHub must be reconfigured from scratch.

### **1.7.2 Fixed in 4.3.1**

1. Fixed MagNIMBUS module functionality in vector mode: Correctly reports the data in vector mode for multiple devices.
2. Fixed Echologger true depth value if sensor reports zero value: True Depth columns are not filled if the sensor reports zero value.
3. Fixed DHCP server operation for stable configuration of Cerulean MBES and RadSys GPR.
4. Fixed some internal bugs, which caused wrong values in SEG-Y files.
5. Fixed installer behavior under unstable network conditions: The installer properly detects network disconnection while the update is in progress.

## **1.8 UgCS-CPM and Skyhub firmware v.4.2.1**

### **1.8.1 Whats New in 4.2.1**

1. GNSS output module supports NMEA RMZ messages.

### **1.8.2 Fixed in 4.2.1**

1. Correct altitude values in GGA message of GNSS output module.
2. Correct DHCP server configuration.

## **1.9 UgCS-CPM and Skyhub firmware v.4.2.0**

### **1.9.1 Whats New in 4.2.0**

1. Mavlink drones can now fly TTF missions with the altimeter connected to the SkyHub.
2. Mavlink drones can now be configured using the SkyHub config file.
3. The SkyHub altimeter can be configured with CPM GUI.

### **1.9.2 Fixed in 4.2.0**

1. Improve GNSS output precision.
2. FT742 anemometer driver reports embedded compass state.
3. The default minimal altitude for the altimeter was changed from 0.5 to 1 meter.
4. Fix missing messages in the CPM console under the high load.
5. The Skyhub checks uploaded missions for at least one Rangefinder point.
6. Fix the true depth header which the Echologger writes into SEG-Y files.

## 1.10 UgCS-CPM and Skyhub firmware v.4.1.2 HOTFIX

### 1.10.1 Fixed in 4.1.2

1. Laser Falcon driver may get stuck on the startup.

## 1.11 UgCS-CPM and Skyhub firmware v.4.1.1

### 1.11.1 Whats New in 4.1.1

1. Supports DJI M350 RTK and DJI M300 RTK drones.
2. License required for SkyHub functions, existing customers should request a license file from SPH Engineering or a reseller.
3. Support for FT42 anemometer with multi instances.
4. Improved performance for MR72 obstacle detector.
5. Improved performance for NRA24 altimeter.

### 1.11.2 Fixed in 4.1.1

1. Improved position.csv log file structure.
2. Reduced number of records in position.csv log file.
3. Improved correction of RTK coordinates.
4. Reduced CPU load for MagNIMBUS and SENSYS MagDrone R1 drivers.
5. Problems with communication with sensors.

## 1.12 UgCS-CPM and Skyhub firmware v.4.1.0

### 1.12.1 Whats New in 4.1.0

1. Supports DJI M350 RTK and DJI M300 RTK drones.
2. License required for SkyHub functions, existing customers should request a license file from SPH Engineering or a reseller.
3. Support for FT42 anemometer with multi instances.
4. Improved performance for MR72 obstacle detector.
5. Improved performance for NRA24 altimeter.

### 1.12.2 Fixed in 4.1.0

1. Improved position.csv log file structure.
2. Reduced number of records in position.csv log file.
3. Improved correction of RTK coordinates.
4. Reduced CPU load for MagNIMBUS and SENSYS MagDrone R1 drivers.

## 1.13 UgCS-CPM and Skyhub firmware v.4.0.3

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**Note** Supports only DJI M350 RTK

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### 1.13.1 Whats New in 4.0.3

1. Support missions without AGL waypoints.
2. Check altimeter range at all flight stages.
3. DJI M350 RTK drones support.
4. True Terrain Following (TTF) route planning in UgCS, including waypoint altitudes using “rangefinder” altitude type.
5. Support of routes with a mix of AGL, AMSL and “rangefinder” altitudes.
6. MagNIMBUS (QuSpin QTFM Gen-2) magnetometer vector add-on support.
7. Sensys MagDrone R1 magnetometer support.
8. Geolux LX-80 water level sensor support.
9. Geolux RSS-2-300 surface velocity radar support.

### 1.13.2 Improvements in 4.0.3

1. Reject mission with negative rangefinder altitude values.
2. Fixed OA activation speed threshold.
3. Improved Magnimbus performance in multi-instance configuration.
4. Reduced time lag for the recorded data.
5. Correct zero point for the GPR SEG-Y log files.
6. Add the next waypoint index column into the position.csv and MagNIMBUS logs.
7. Wind sensor FTT372 does not use an embedded compass any more.

## 1.14 UgCS-CPM and Skyhub firmware v.4.0.0

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**Note** Supports only DJI M350 RTK

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### 1.14.1 Whats New in 4.0.0

1. DJI M350 RTK drones support.
2. True Terrain Following (TTF) route planning in UgCS, including waypoint altitudes using “rangefinder” altitude type.
3. Support of routes with a mix of AGL, AMSL and “rangefinder” altitudes.
4. MagNIMBUS (QuSpin QTFM Gen-2) magnetometer vector add-on support.
5. Sensys MagDrone R1 magnetometer support.
6. Geolux LX-80 water level sensor support.
7. Geolux RSS-2-300 surface velocity radar support.

### 1.14.2 Improvements in 4.0.0

1. Reduced time lag for the recorded data.
2. Correct zero point for the GPR SEG-Y log files.
3. Add the next waypoint index column into the position.csv and MagNIMBUS logs.
4. Wind sensor FTT372 does not use an embedded compass any more.

### 1.14.3 Dropped support in 4.0.0

1. Geonics EM38-MK2 metal detector.
2. Geonics EM-61 conductivity meter.
3. Attollo Wasp laser altimeter.
4. Lightware SF11/C laser altimeter.
5. Radarteam Cobra Plug-In GPR.

## 1.15 UgCS-CPM and Skyhub firmware v.3.19

### 1.15.1 Whats New in 3.19

1. Support for multiple scalar widgets was added.
2. Support for QuSpin Gen-2 magnetometer added.
3. Possible to install CPM into an existing directory.

### 1.15.2 Fixed in 3.19

1. Fixed saving of TTF configuration.
2. Fixed Skyhub logs download.

### 1.15.3 Dropped support in 3.19

1. Removed support for SkyHub v2.

## 1.16 UgCS-CPM and Skyhub firmware v.3.18

### 1.16.1 Whats New in 3.18

1. New SkyHub ROS-based SDK for third-party modules development.
2. Improved Lightware SF-30/D altimeter support: reduced time lag, filtering support.
3. Added support for Ainteins US-D1 altimeter.
4. Automatically select altitude source depending on the aircraft simulation state for TTF and GH modes.
5. The pulse delay value for Radsys Zond Aero LF GPR determined with Prism software can be used in SkyHub configuration as is.

6. Echo sounders parameters are aligned with the vendor's manual: FREQUENCY\_HZ becomes INTERVAL\_S. Values must be changed from Hz to seconds.



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## Description

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The SkyHub solution is a hardware and software set designed to enhance commercial-off-the-shelf UAV capabilities for industrial purposes and to support integration of diverse sensors.

SkyHub solution functions:

- Data collection from sensors like GPR, methane detector, echosounder, etc. which do not have an internal data logger. Data is recorded in CSV format as well as in formats compatible with specialized software for sensor data processing and analysis (SEG-Y, NMEA-0183, etc.).
- Data fusion from the payload and UAV telemetry. Data without coordinates (non-geotagged) is in most cases useless. SkyHub uses the positioning information from the drone to geotag sensor data.
- SkyHub can supply a NMEA coordinate stream to external sensors. Some sensors have internal data recorders but require an external GPS receiver. SkyHub can act as an additional GPS receiver by providing the UAV coordinates to sensors.
- Support for True Terrain Following for DJI drones to automatically keep constant elevation over the surface using real-time data from a radar or laser altimeter.
- Support for Grasshopper mode for DJI drones. The mode provides flight between waypoints at a safe altitude and descends at waypoints to the set altitude to make measurements (using NDT sensor, echosounder, etc.) or to drop a parcel or seismic sensor.
- Support for an external detector of obstacles to interrupt the flight and save the UAV, especially if the weather conditions or payload configuration interfere with the built-in sensors on the UAV or the UAV does not have such sensors.
- Supports power output up to 5V/1A via the USB port.

### 2.1 Compatible drones

- DJI Matrice 400
- DJI M350 RTK
- DJI M300 RTK
- Pixhawk-compatible (Cube) autopilots with ArduPilot or PX4 firmware

## 2.2 Interaction diagrams with drones

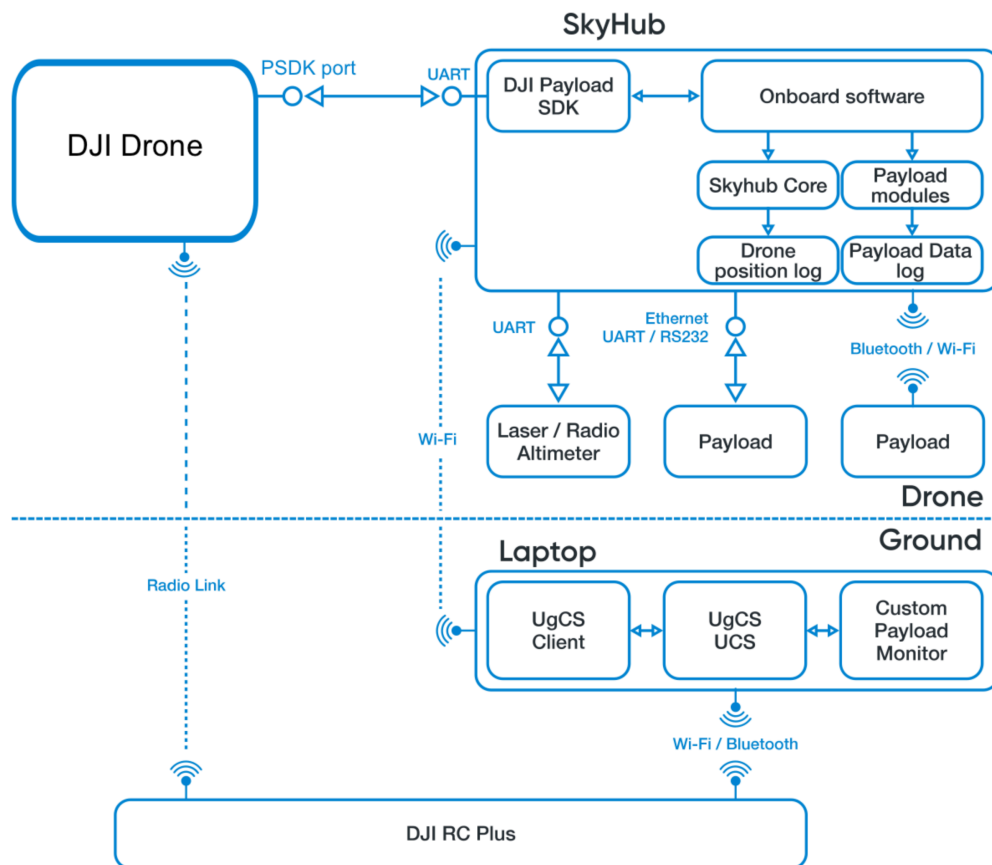


Figure 2.1. DJI SDK drone interaction diagram



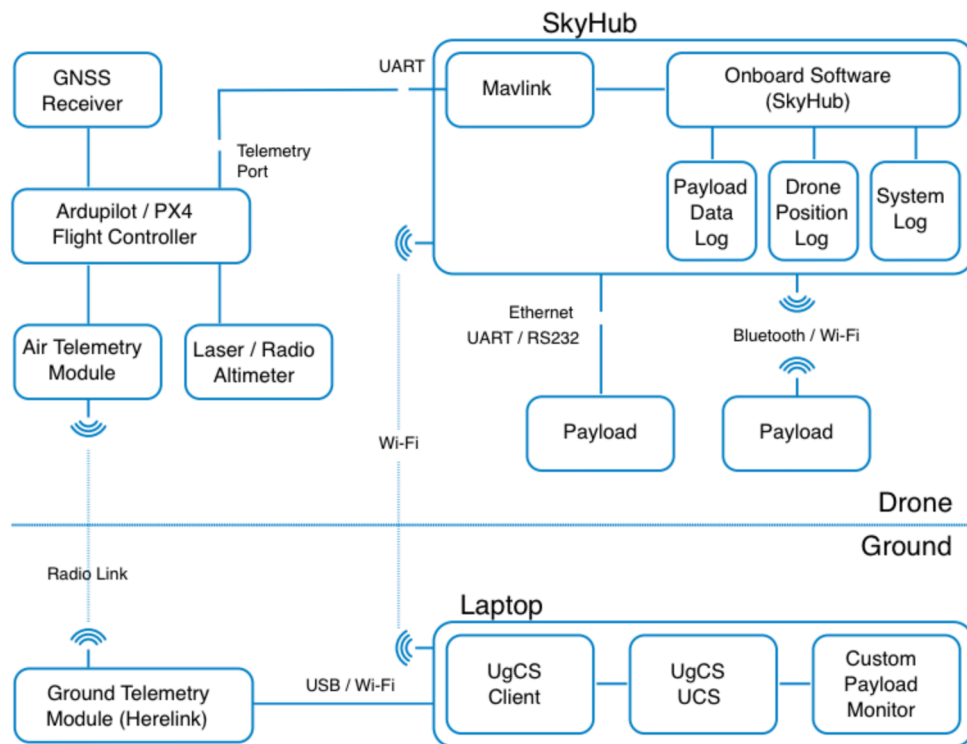


Figure 2.2. Pixhawk autopilot based drone interaction diagram



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## Supported sensors

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### 3.1 Altimeter

(used for flight control in True Terrain-Following (TTF) and Grasshopper (GH) flight modes)

| Manufacturer    | Sensor name | Data logging on Skyhub | Data / control interface | Power feed from Skyhub | Power consumption | Notes            |
|-----------------|-------------|------------------------|--------------------------|------------------------|-------------------|------------------|
| Nanoradar       | NRA24       | YES                    | UART                     | 5V                     | 1.4W              | Max range: 50 m  |
| LightWare Lidar | SF30/D      | YES                    | UART                     | 5V                     | 1.25W             | Max range: 200 m |
| Ainstein AI     | US-D1       | YES                    | UART                     | 12V                    | 2W                |                  |

### 3.2 Ground-Penetrating Radar (GPR)

| Manufacturer | Sensor name       | Data logging on Skyhub | Data / control interface | Power feed from Skyhub | Power consumption | Notes |
|--------------|-------------------|------------------------|--------------------------|------------------------|-------------------|-------|
| Radar System | Zond Aero 500     | YES                    | Ethernet                 | 12V                    | 7.2W              |       |
| Radar System | Zond Aero 600     | YES                    | Ethernet                 | 12V                    | 7.2W              |       |
| Radar System | Zond Aero 1000    | YES                    | Ethernet                 | 12V                    | 7.2W              |       |
| Radar System | Zond Aero LF & NG | YES                    | Ethernet                 | 12V                    | 7.2W              |       |

### 3.3 Magnetometer

| Manufacturer    | Sensor name                                       | Data logging on Skyhub | Data / control interface | Power feed from Skyhub             | Power consumption | Notes                          |
|-----------------|---------------------------------------------------|------------------------|--------------------------|------------------------------------|-------------------|--------------------------------|
| SENSYS          | MagDrone R3 / R4                                  | -                      | -                        | 12V                                | R3: 6W ; R4: 10W  | GPS feed (GPS-out) from Skyhub |
| SENSYS          | MagDrone R1                                       | Yes                    | USB                      | 24V                                | 2W                |                                |
| SPH Engineering | MagNIMBUS (with QuSpin Gen-2 magnetometer sensor) | Yes                    | UART                     | 5V for USB; 12V/5V for SwitchCraft | 5W                |                                |

### 3.4 Echosounders

| Manufacturer    | Sensor name                                               | Data logging on Skyhub | Data / control interface | Power feed from Skyhub | Power consumption | Notes          |
|-----------------|-----------------------------------------------------------|------------------------|--------------------------|------------------------|-------------------|----------------|
| Echologger      | ECT 400S                                                  | YES                    | RS-232                   | 12V                    | 2W                | Optionally USB |
| Echologger      | ETF 400S                                                  | YES                    | RS-232                   | 12V                    | 2W                | Optionally USB |
| Echologger      | ECT D052S                                                 | YES                    | RS-232                   | 12V                    | 2W                | Optionally USB |
| Echologger      | ECT D032S                                                 | YES                    | RS-232                   | 12V                    | 2W                | Optionally USB |
| Echologger      | ECT D24S                                                  | YES                    | RS-232                   | 12V                    | 2W                | Optionally USB |
| SPH Engineering | EchoNIMBUS MBES (with Cerulean Surveyor 240-16 sensor)    | YES                    | Ethernet                 | 12V                    | 15W               |                |
| SPH Engineering | EchoNIMBUS SSS (with 2 * Cerulean Omniscan 450SS sensors) | YES                    | Ethernet                 | 12V                    | 20W               |                |

### 3.5 Methane detector

| Manufacturer | Sensor name  | Data logging on Skyhub | Data / control interface | Power feed from Skyhub | Power consumption | Notes |
|--------------|--------------|------------------------|--------------------------|------------------------|-------------------|-------|
|              | Laser Falcon | YES                    | USB                      | 5V                     | 7.5W              |       |

|         |                           |     |          |     |     |  |
|---------|---------------------------|-----|----------|-----|-----|--|
|         | Laser Falcon 2            | YES | UART     | 5V  | 10W |  |
|         | Laser Falcon Plus         | YES | Ethernet | 12V | 6W  |  |
| Axetris | FluX Aero Methane Sniffer | YES | UART     | 12V |     |  |

### 3.6 Metal detector

| Manufacturer | Sensor name | Data logging on Skyhub | Data / control interface | Power feed from Skyhub | Power consumption | Notes |
|--------------|-------------|------------------------|--------------------------|------------------------|-------------------|-------|
| Ebinger      | VEMOS AIR   | YES                    | UART                     | 12V                    | 4.3W              |       |

### 3.7 Other sensors and devices

| Manufacturer    | Sensor name                            | Data logging on Skyhub | Data / control interface | Power feed from Skyhub           | Power consumption            | Notes                             |
|-----------------|----------------------------------------|------------------------|--------------------------|----------------------------------|------------------------------|-----------------------------------|
| FT Technologies | FT742 anemometer                       | YES                    | UART                     | 12V                              | 0.3-24W (depends on heating) |                                   |
| FT Technologies | FT602 anemometer                       | YES                    | UART                     | 12V                              | 0.2W                         |                                   |
| Nanoradar       | MR72 obstacles detector                | YES                    | UART                     | 12V                              | 2.5W                         |                                   |
| Emlid           | Reach M2                               | YES                    | UART / USB               | Externally powered               |                              |                                   |
| SPH Engineering | Water sampler messenger release device | -                      | GPIO / PWM               |                                  |                              | Tested with Ruttner water sampler |
| Geolux          | LX-80                                  | YES                    | UART / CAN               | For sensor: 12V; For gimbal: 24V | 1.85W(sensor);7.2W(gimbal)   |                                   |
| Geolux          | RSS2-300W                              | YES                    | UART / CAN               | 12V                              | 0.95W                        |                                   |



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### 4.4 Contact & Support

Latest documentation is available on <https://www.sphengineering.com/integrated-systems/downloads>

For support and inquiries:

- Email: [support@sphengineering.com](mailto:support@sphengineering.com)
- Website: <https://www.sphengineering.com/support>



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## Preparation

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### 5.1 Prerequisites

Required desktop software:

- UgCS Custom Payload Monitor v4.3.0 or higher (referred to below as **UgCS-CPM**).
- UgCS v5.13.0 or higher (referred to below as **UgCS**).

Required mobile software for DJI drones and remote controller:

- DJI Pilot 2 (referred to below as **DJI Pilot**)
- UgCS Companion v1.6.3. or higher

Optional:

- RJ45 Ethernet cable if the wired Auxiliary connection will be necessary.

#### 5.1.1 Establish Auxiliary connection to SkyHub using Wi-Fi

**Important:** It is strongly recommended to switch on a remote controller before any operations with the SkyHub Wi-Fi.

After powering on, the SkyHub operates as a Wi-Fi access point with the following credentials:

- SSID: UgCS-SkyHub- \*\*\*\*\* (where \*\*\*\*\* is the SkyHub serial number)
- Passphrase: 12341234

---

**Note** When connecting to SkyHub Wi-Fi for the first time, Windows will require authentication with a PIN. It is necessary to choose network security key authentication instead. Please switch to security key mode before entering the passphrase.

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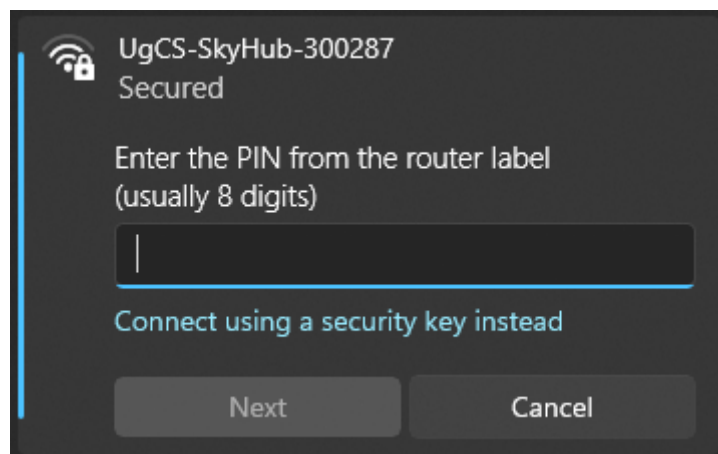


Figure 5.1. Windows Wi-Fi connection dialog, PIN mode

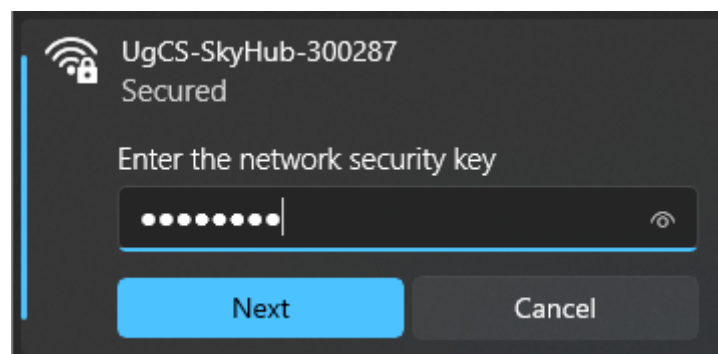


Figure 5.2. Windows Wi-Fi connection dialog, Security key mode.

When connection to the SkyHub hotspot is established:

1. Open the UgCS-CPM software.
2. Press “Settings”.
3. Verify that the address is set to 10.1.0.1.

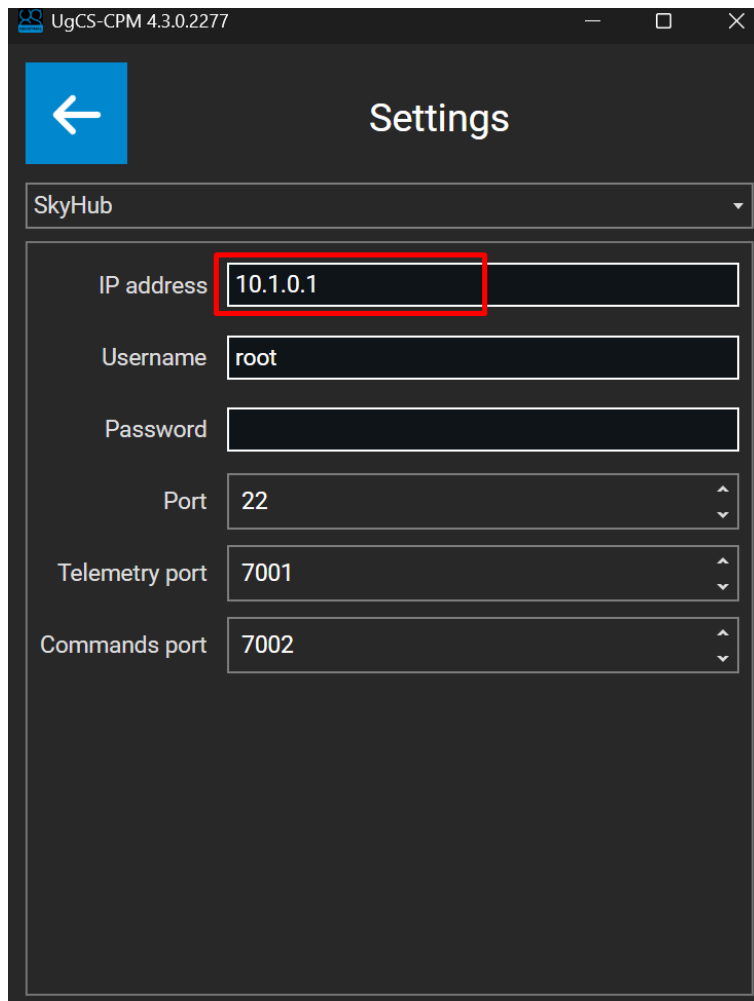


Figure 5.3. Wi-Fi address within UgCS-CPM

4. Press the “back arrow” and refresh the connection list.
5. The Auxiliary connection is established.

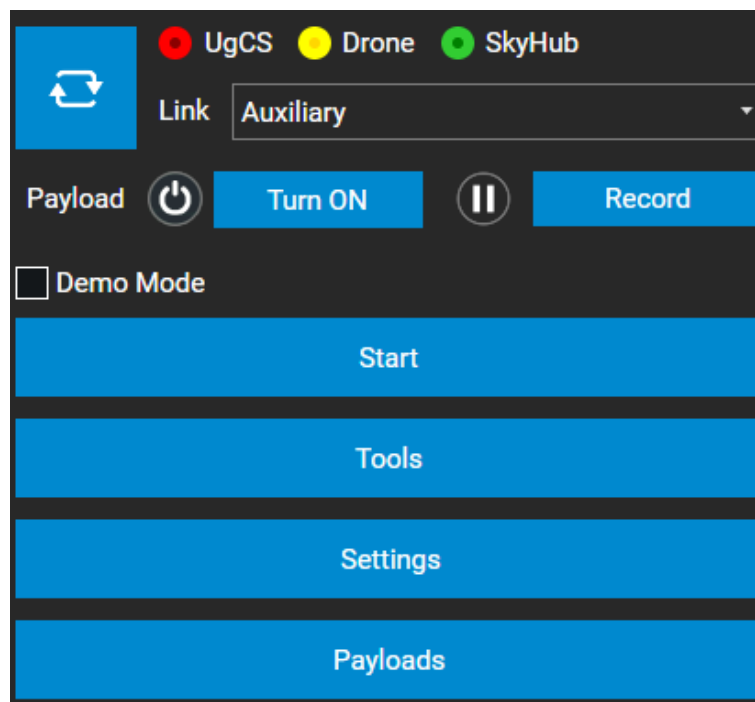


Figure 5.4. Auxiliary link in UgCS-CPM

### 5.1.2 Establish Auxiliary connection to SkyHub using Ethernet cable

1. Connect one end of the Ethernet cable to the RJ45 port on your computer.
2. Connect the other end of the Ethernet cable to the SkyHub Ethernet port.

---

**Note** SkyHub runs DHCP service onboard, therefore, the PC's IP address will be assigned automatically after connection.

---

3. Open the UgCS-CPM software.
4. Press "Settings".
5. Verify that the address is set to 10.2.0.1

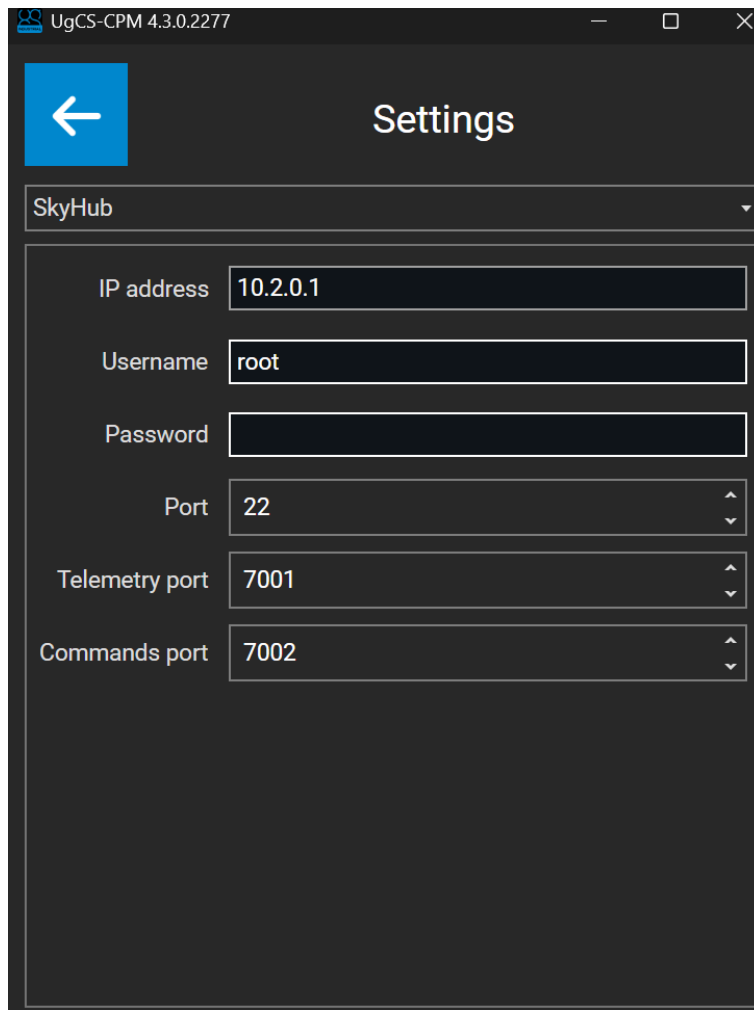


Figure 5.5. Ethernet address within UgCS-CPM

6. Press the “back arrow” and refresh the connection list.
7. The Auxiliary connection is established.

**Warning** If your network adapter has manual TCP/IP settings applied, make sure to switch both IP and DNS to “Automatic”.

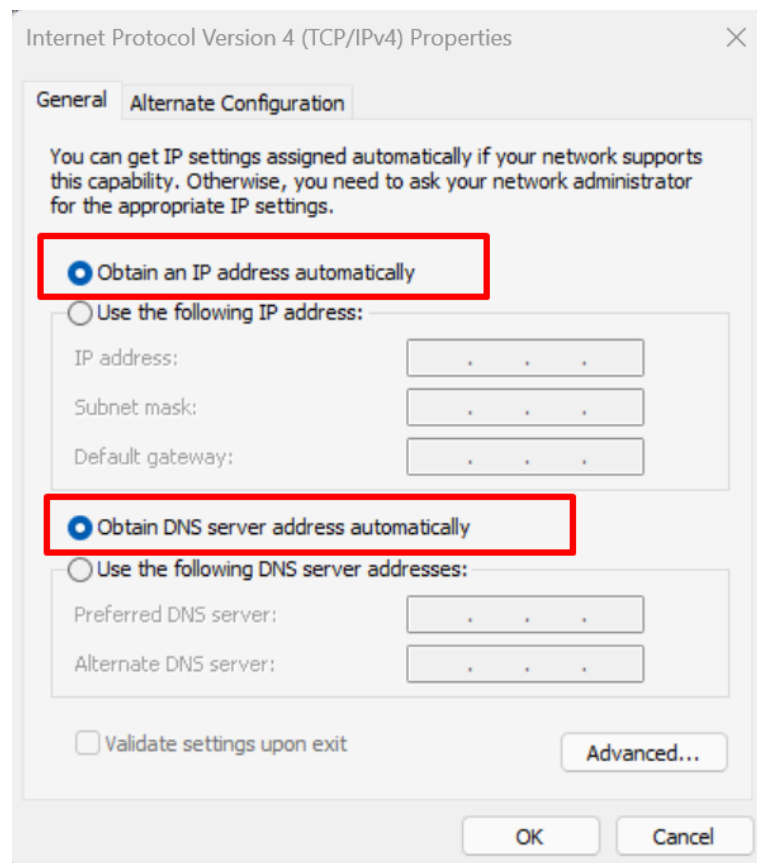


Figure 5.6. Network adapter settings on computer

---

## Assembling

---

1. Attach both mounting kits on the back side of the SkyHub.
2. Plug in the drone link cable (Red) to the third connector (Red) on the SkyHub.
3. Plug the power cable into either the first or second power port on SkyHub.
4. Plug in a USB cable to the DJI OSDK port on the drone (note that the USB can only be plugged in one direction; use the railing on the connector as guidance).
5. Attach the anchor cable to the case of the drone beneath the DJI OSDK port.
6. SkyHub assembly on the drone is complete.

Visual instructions on how to mount SkyHub and an altimeter are available in the video below:

Video available at: <https://youtu.be/qjouqKcKZfE>

You can also watch it directly on [YouTube](#).

### 6.1 Power-on checks

The cable connecting SkyHub and DJI M350 RTK drones has built-in LED indicators. You can check the connection status by examining them:



Figure 6.1. Numbered LEDs on cable

- LED1 lights up when power is coming from the drone.
- LED2 blinks when there is communication from the drone.
- LED3 blinks when there is communication from SkyHub.

- LED2 lights up fully when the connection is established.



---

## Quick Start: DJI M400 RTK

---

### 7.1 Hardware requirements

- DJI M400 drone
- SkyHub V3 (with mounting kit)
- SkyHub 3 smart cable with the mounting bracket
- Altimeter (laser or radar)

### 7.2 Software requirements for the Windows PC

- UgCS v5.14.0 or higher (referred to below as **UgCS**)
- UgCS Custom Payload Monitor v4.4.0 or higher (referred to below as **UgCS-CPM**)

### 7.3 Software requirements for the Remote Controller

- UgCS Companion for M350 v1.8.0 or higher
- DJI Pilot 2 (to disable built-in obstacle avoidance sensors and RTK configuration)

### 7.4 Network requirements

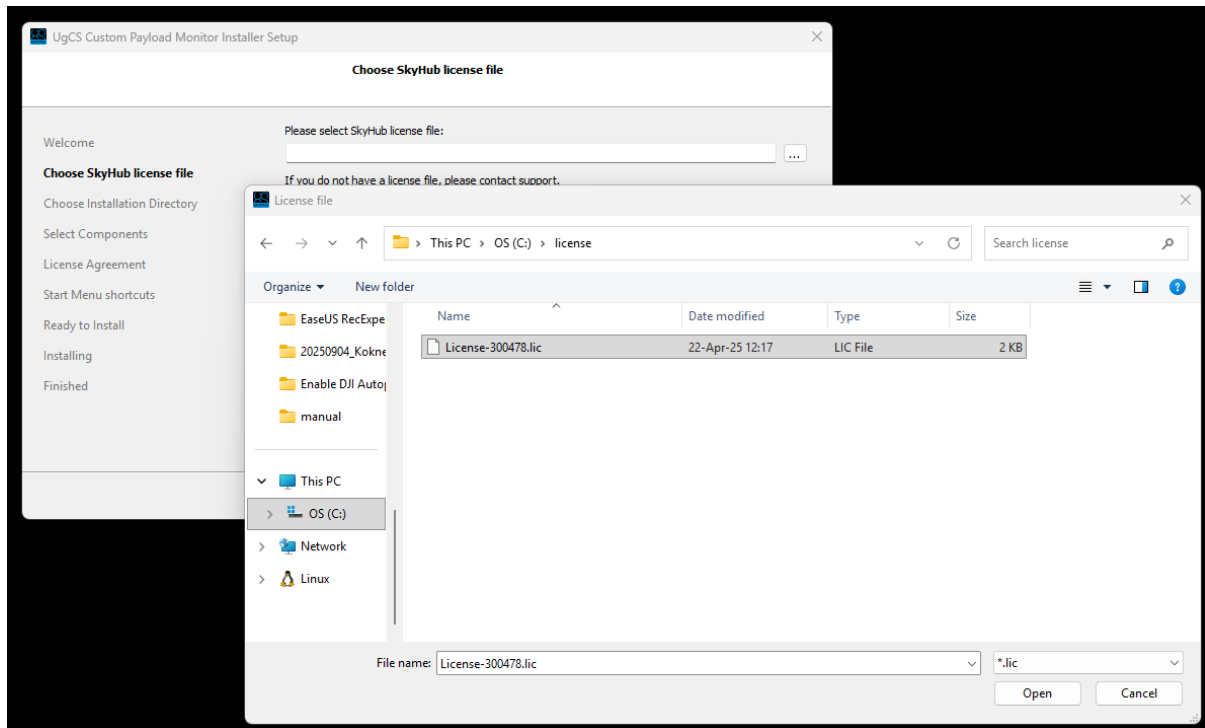
Any Wi-Fi/hotspot to connect the Remote Controller and the Windows PC within a single network.

#### 7.4.1 UgCS desktop download and setup process

1. Download the installation package: <https://www.sphengineering.com/flight-planning/ugcs-downloads>
2. Run the setup file.
3. Read and acknowledge the license agreement.
4. In the component selection tab, you can select additional autopilot support (if necessary).
5. Installation complete.

## 7.4.2 UgCS Custom Payload Monitor download and setup process

1. Download the latest available CPM version here: <https://www.sphengineering.com/integrated-systems/-downloads>
2. Run the setup file.
3. Select the SkyHub license file for the SkyHub you will be using.



4. Read and acknowledge the license agreement.
5. Installation complete.

**Note** If you do not have a license file or need a new one, please reach out to us at [support@ugcs.com](mailto:support@ugcs.com) and provide your SkyHub serial number.

## 7.4.3 SkyHub installation on the drone

**Warning** Power off the system when connecting cables. To avoid short-circuiting or causing potentially harmful power fluctuations, it is recommended to power off the entire system before performing any cable plug-in or unplugging. Some of the payload sensors used are extremely sensitive to power changes and may be damaged.

## 7.5 Components

SkyHub assembly kit contains the following components:

- SkyHub onboard computer
- 2x SkyHub case mounts

- DJI M400 connection cable with mounting bracket



## 7.6 Physical assembly

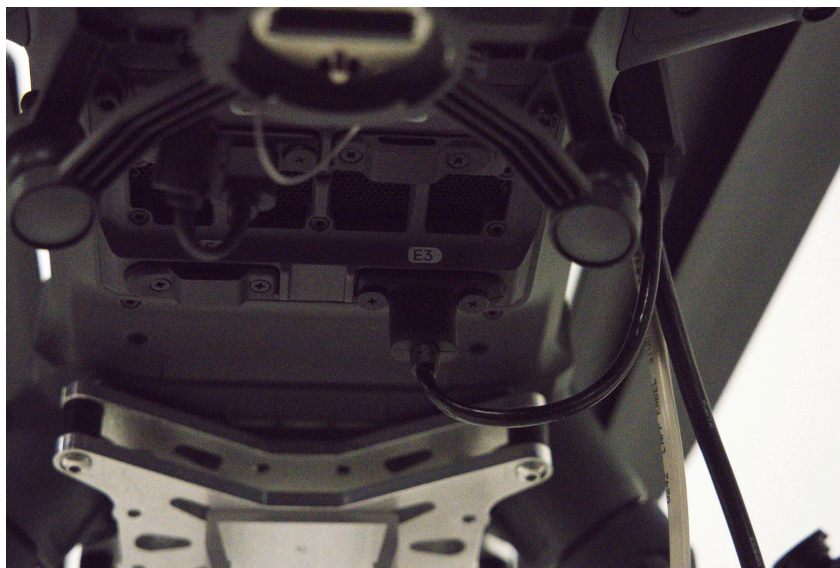
1. Attach both mounting kits on the back side of the SkyHub.
2. Place the cable bracket somewhere between the drone arm and leg. This will provide optimal distance to connect the rest of the cables during further setup.



3. When mounts are in place, attach the SkyHub to the leg of the drone and put the cable in the bracket.



4. Attach the DJI PSDK connector to the E3 port beneath the drone.



5. Attach USB and power cable to the SkyHub.





6. Physical assembly of the SkyHub is complete. Check that all the connectors are secured tightly, with no loose movements.

### 7.6.1 Altimeter installation on the drone and connection to the SkyHub

To install the altimeter sensor on the DJI M400, use the mountings provided with the sensor.

For your convenience, we have a library with 3D models you can download and print yourself in case the default ones are broken or missing: <https://files.ugcs.com/s/fMpj5LJpobWeMFi>

1. Slide the plastic ruller on the front of the gimbal and tigthen it with the two screws.



2. Slide the altimeter vertically on the previously attached ruller.



3. Adjust the altimeter position by rotating it downwards or upwards.



---

**Note** If you wish to detach the sensor, simply perform the same action in reverse. Place the altimeter in the vertical position and slide it up from the gimbal.

---

4. Connect the cable to Connector 1 (yellow) on the SkyHub.



4. Setup is complete. You can now proceed with the widget configuration.

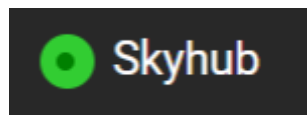
### 7.6.2 Altimeter / Autopilot configuration within the CPM software

Before proceeding further, power on both the drone and remote controller. Then, make sure that your computer and the controller are connected to the same network. This is required to establish the drone link connection between CPM on your computer and SkyHub on the drone.

---

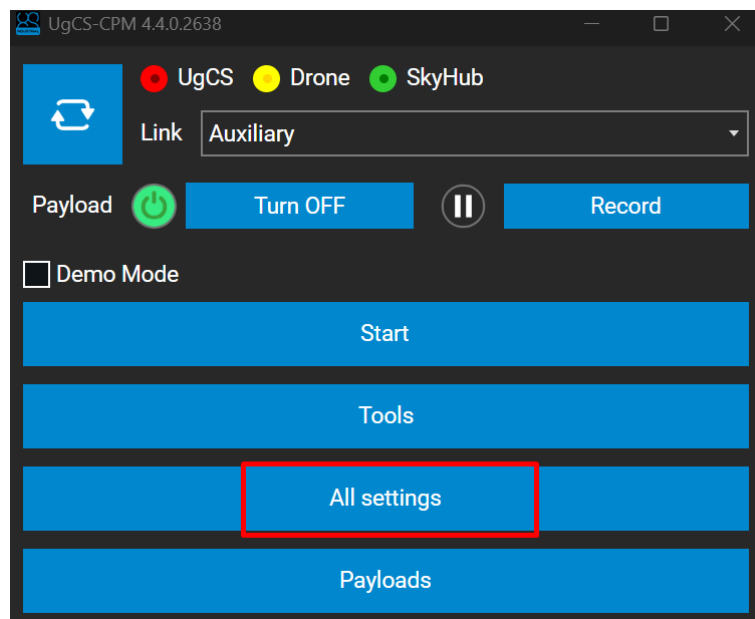
**Note** SkyHub will take a little more time to fully boot up. You can check whether it is ready by the indicator within CPM. As soon as the SkyHub indicator becomes green, you can proceed with the configuration.

---

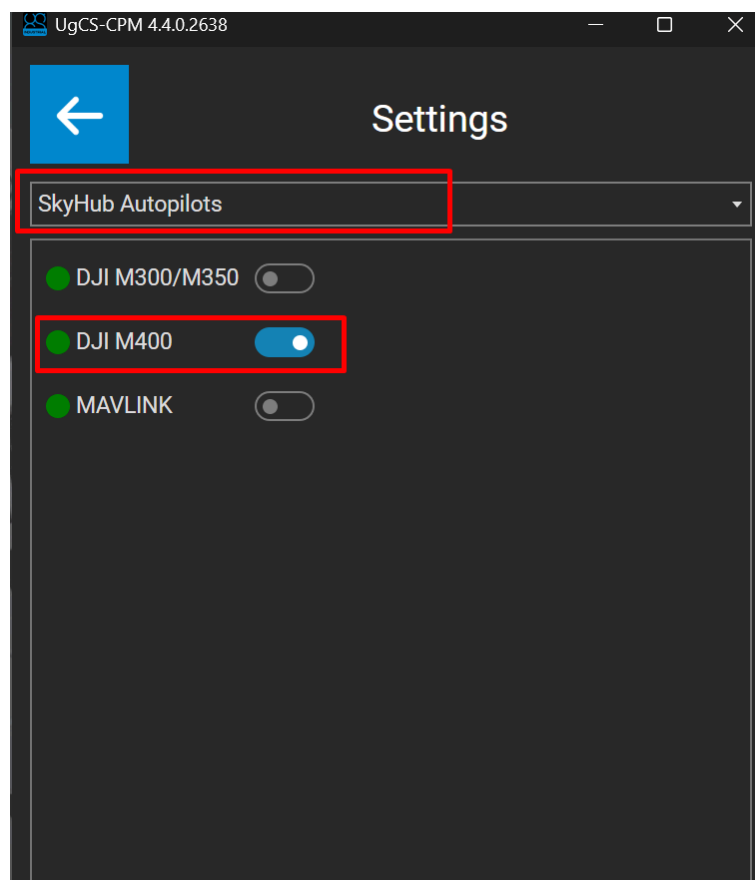


## 7.7 Enabling the autopilot

1. Press the “All settings” button.

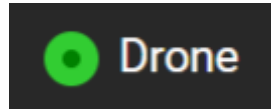


2. From the drop-down list, select the “SkyHub Autopilots” section.
3. Enable DJI M400 (note that only one autopilot can be enabled at a time). Press Save and perform a system restart.





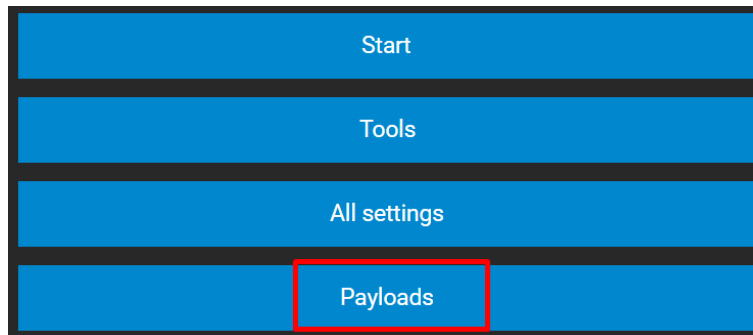
Autopilot configuration is complete. After the system restart, you will notice that the drone link icon should become green.



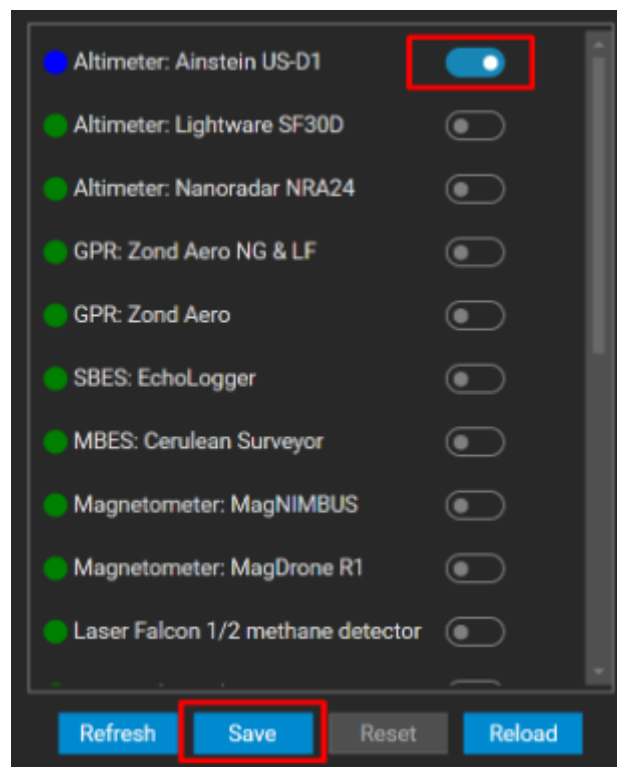
## 7.8 Enabling the altimeter

When both drone link and SkyHub connections are established, you can proceed with the altimeter widget configuration.

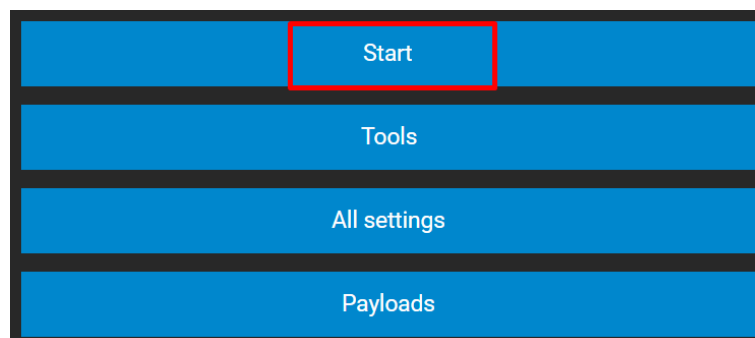
1. Click on the Payloads section



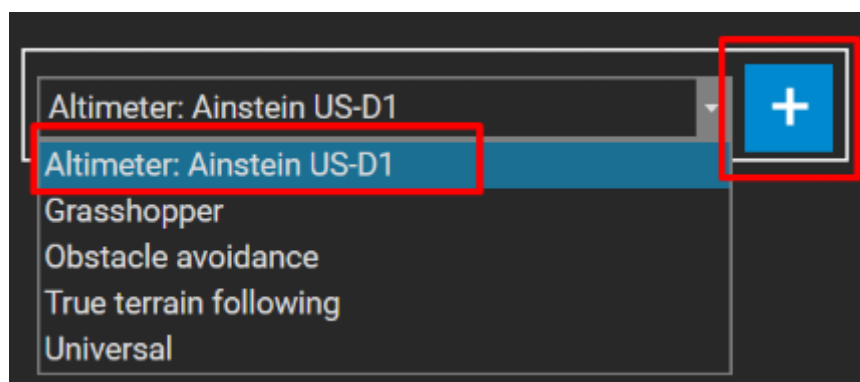
2. From the payload list, search for your altimeter model (in our example, it is US-D1), enable it, and press the Save button. Perform a system restart.



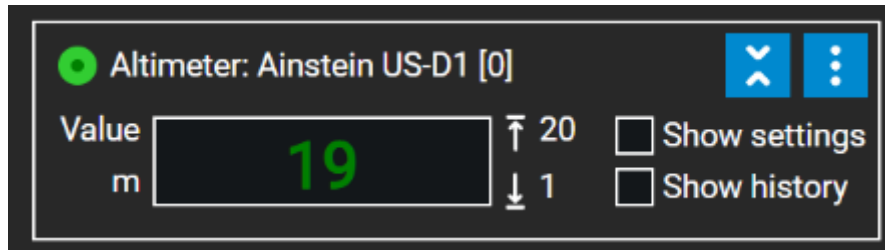
3. After the restart is complete, press the Start button.



4. From the drop-down list, select the altimeter model you enabled previously and press the “plus” icon



Widget configuration is complete. If everything was set up correctly, you should see the initial readings from the sensor.





---

## Quick Start: DJI M300/M350 RTK

---

### 8.1 Hardware requirements

- DJI M300/M350 RTK drone
- SkyHub V3 (with mounting kit)
- Altimeter (laser or radar)
- Obstacle sensor (optional)

### 8.2 Software requirements for the Windows PC

- UgCS v5.13.0 or higher (referred to below as **UgCS**)
- UgCS Custom Payload Monitor v4.3.0 or higher (referred to below as **UgCS-CPM**)

### 8.3 Software requirements for the Remote Controller

For DJI M300 users:

- UgCS Companion for M300 V1.6.3 or later (to establish drone link connection with the CPM)

For DJI M350 users:

- UgCS Companion for M350, M30, M3E V1.6.3 or later (to establish drone link connection with the CPM)
- DJI Pilot 2 (to disable built-in obstacle avoidance sensors and RTK configuration)

### 8.4 Network requirements

Any Wi-Fi/hotspot to connect the Remote Controller and the Windows PC within a single network.

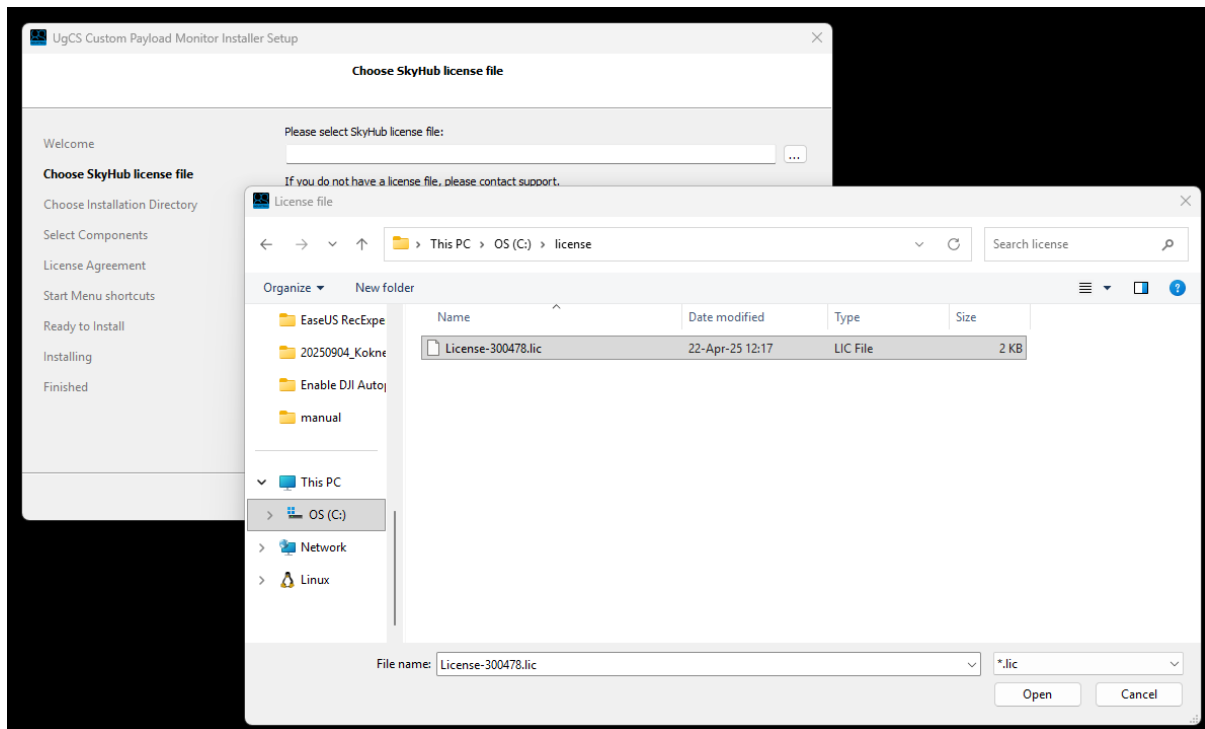
#### 8.4.1 UgCS desktop download and setup process

1. Download the installation package: <https://www.sphengineering.com/flight-planning/ugcs-downloads>
2. Run the setup file.
3. Read and acknowledge the license agreement.

4. In the component selection tab, you can select additional autopilot support (if necessary).
5. Installation complete.

### 8.4.2 UgCS Custom Payload Monitor download and setup process

1. Download the latest available CPM version here: <https://www.sphengineering.com/integrated-systems/-downloads>
2. Run the setup file.
3. Select the SkyHub license file for the SkyHub you will be using.



4. Read and acknowledge the license agreement.
5. Installation complete.

**Note** If you do not have a license file or need a new one, please reach out to us at [support@ugcs.com](mailto:support@ugcs.com) and provide your SkyHub serial number.

### 8.4.3 SkyHub installation on the drone

**Warning** Power off the system when connecting cables. To avoid short-circuiting or causing potentially harmful power fluctuations, it is recommended to power off the entire system before performing any cable plug-in or unplugging. Some of the payload sensors used are extremely sensitive to power changes and may be damaged.

## 8.5 Components

SkyHub assembly kit contains the following components:

- SkyHub onboard computer
- 2x case mounts
- DJI M300/M350 connection cable



## 8.6 Physical assembly

1. Attach both mounting kits on the back side of the SkyHub
2. Plug in the drone link cable (Red) to the third connector (Red) on the SkyHub
3. Plug the power cable into either the first or second power port on SkyHub



4. Plug in a USB cable to the OSDK USB port on the drone (note that the USB can only be plugged in one direction; use the railing on the connector as guidance)
5. Attach the anchor cable to the case of the drone beneath the OSDK port.



6. Physical assembly of the SkyHub is complete. Check that all the connectors are secured tightly, with no loose movements.





### 8.6.1 Altimeter installation on the drone and connection to the SkyHub

To install the altimeter sensor on the DJI M300/M350, use the mountings provided with the sensor.

For your convenience, we have a library with 3D models you can download and print yourself in case the default ones are broken or missing: <https://files.ugcs.com/s/fMpj5LJpobWeMFj>

1. Attach the mountings to the sensor. Note that mounts fit only one way and should slide in easily without too much force being applied. When the mounts are fitted, tighten them with the screws.



2. Install the sensor on the gimbal of your drone. The mounts should slide in deep enough to be tightly secured on the gimbal, without loose movement.
3. Connect the cable to Connector 1 (yellow) on the SkyHub



4. Setup is complete. You can now proceed with the widget configuration.

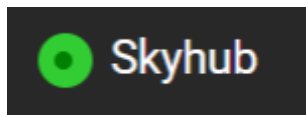
### 8.6.2 Altimeter / Autopilot configuration within the CPM software

Before proceeding further, power on both the drone and remote controller. Then, make sure that your computer and the controller are connected to the same network. This is required to establish the drone link connection between CPM on your computer and SkyHub on the drone.

---

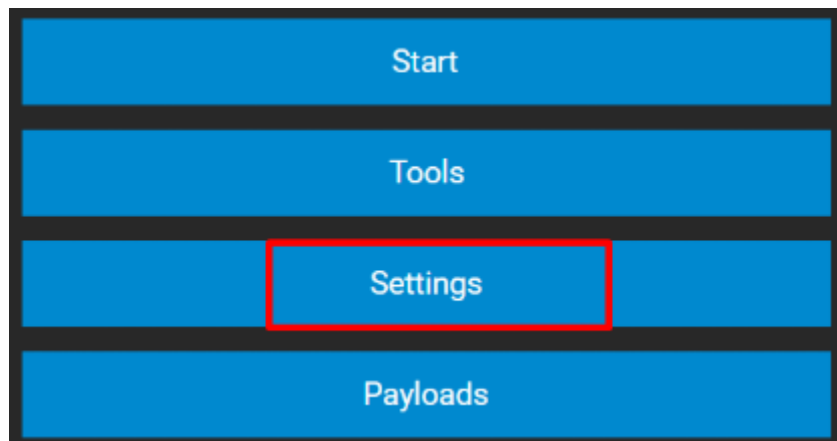
**Note** SkyHub will take a little more time to fully boot up. You can check whether it is ready by the indicator within CPM. As soon as the SkyHub indicator becomes green, you can proceed with the configuration.

---

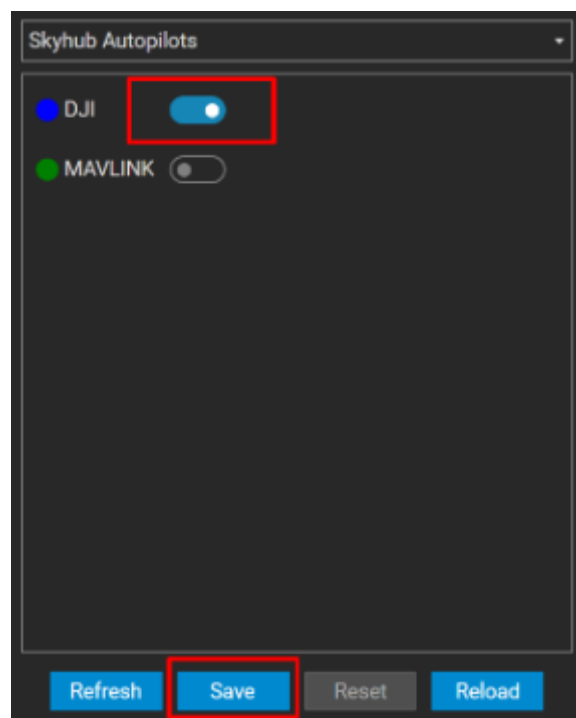


## 8.7 Enabling the autopilot

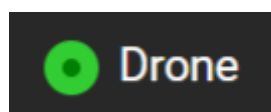
1. Press the Settings button



2. From the drop-down list, select the SkyHub Autopilots section
3. Enable DJI (note that only one autopilot can be enabled at a time; MAVLINK should stay disabled). Press Save and perform a system restart



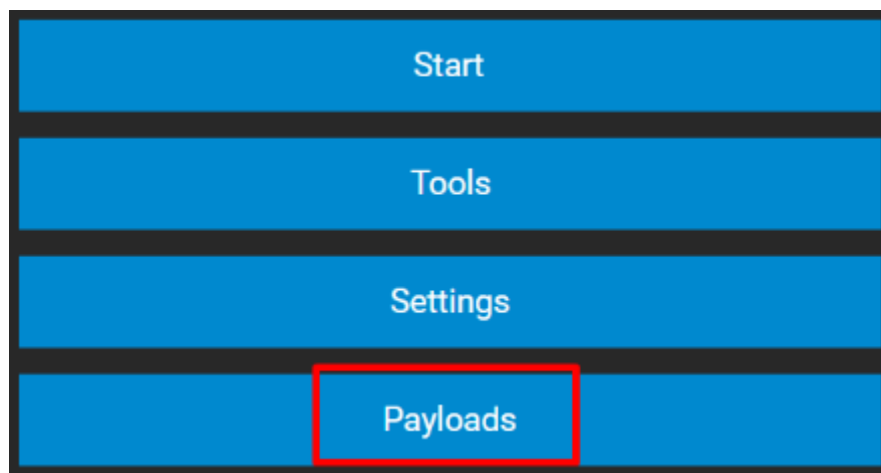
Autopilot configuration is complete. After the system restart, you will notice that the drone link icon should become green.



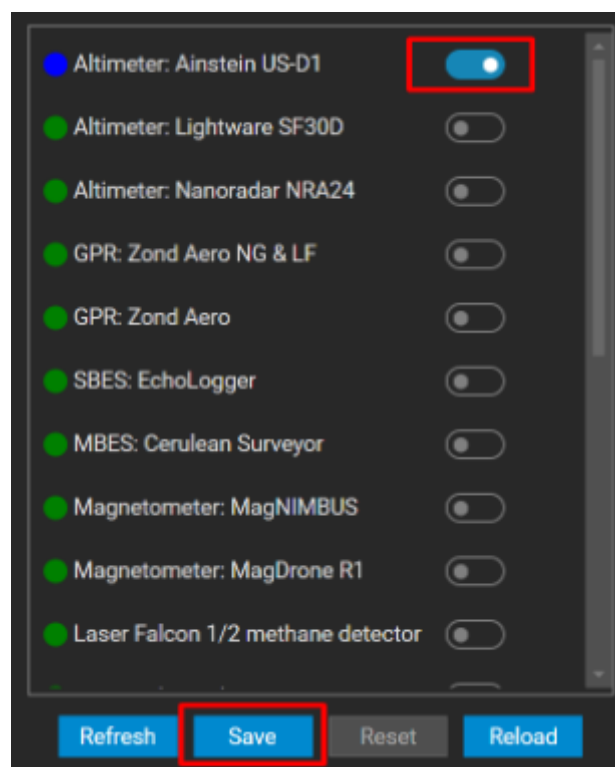
## 8.8 Enabling the altimeter

When both drone link and SkyHub connections are established, you can proceed with the altimeter widget configuration.

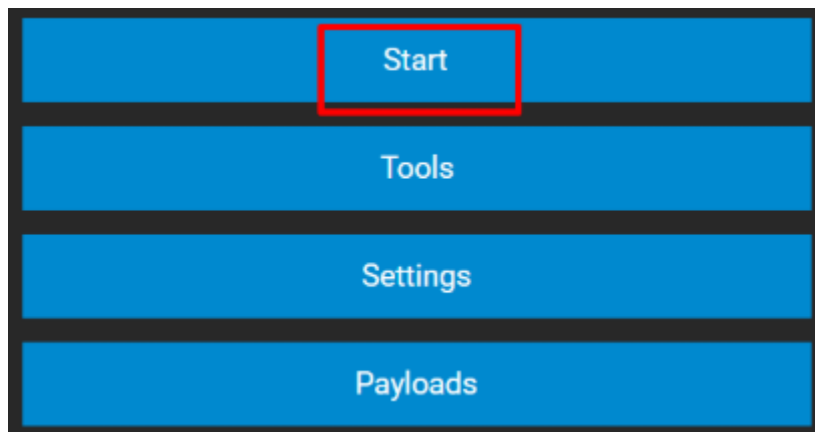
1. Click on the Payloads section



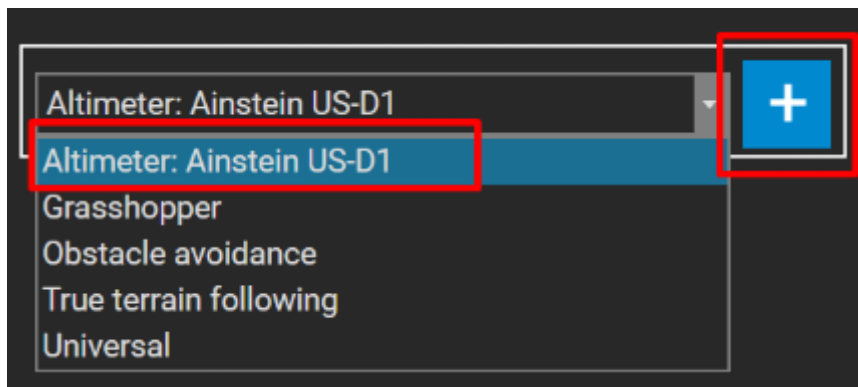
2. From the payload list, search for your altimeter model (in our example, it is US-D1), enable it, and press the Save button. Perform a system restart.



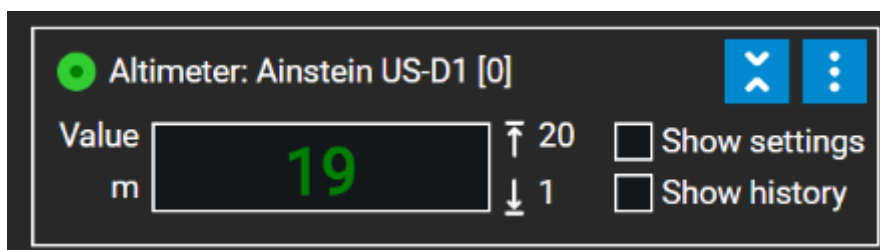
3. After the restart is complete, press the Start button.



4. From the drop-down list, select the altimeter model you enabled previously and press the “plus” icon



Widget configuration is complete. If everything was set up correctly, you should see the initial readings from the sensor.





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## Quick Start: IF800 Tomcat

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### 9.1 Hardware requirements

- IF800 Tomcat drone
- SkyHub V3 (with mounting kit)
- SkyHub cable for Pixhawk Payload Bus
- Altimeter (laser or radar) with a mounting bracket

### 9.2 Software requirements for the Windows PC

- UgCS v5.14.0 or higher (referred to below as **UgCS**)
- UgCS Custom Payload Monitor v4.4.0 or higher (referred to below as **UgCS-CPM**)

### 9.3 Software requirements for the Remote Controller

- Inspired Ground Control v1.5.4 or higher

### 9.4 Network requirements

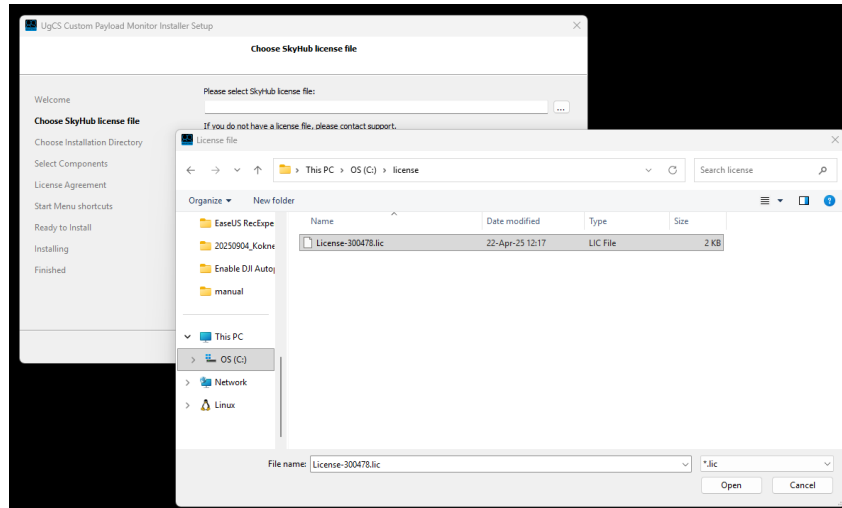
- Any Wi-Fi/hotspot to connect the Remote Controller and the Windows PC within a single network.

#### 9.4.1 UgCS desktop download and setup process

1. Download the installation package: <https://www.sphengineering.com/flight-planning/ugcs-downloads>
2. Run the setup file.
3. Read and acknowledge the license agreement.
4. In the component selection tab, you can select additional autopilot support (if necessary).
5. Installation complete.

### 9.4.2 UgCS Custom Payload Monitor download and setup process

1. Download the latest available CPM version here: <https://www.sphengineering.com/integrated-systems/-downloads>
2. Run the setup file.
3. Select the SkyHub license file for the SkyHub you will be using.



4. Read and acknowledge the license agreement.
5. Installation complete.

**Note** If you do not have a license file or need a new one, please reach out to us at [support@ugcs.com](mailto:support@ugcs.com) and provide your SkyHub serial number.

### 9.4.3 SkyHub installation on the drone

**Warning** Power off the system when connecting cables. To avoid short-circuiting or causing potentially harmful power fluctuations, it is recommended to power off the entire system before performing any cable plug-in or unplugging. Some of the payload sensors used are extremely sensitive to power changes and may be damaged.

## 9.5 Components

SkyHub assembly kit contains the following components:

- SkyHub onboard computer
- SkyHub cable for Pixhawk Payload Bus
- Altimeter mounting bracket





## 9.6 Physical assembly

**Warning** It is advised to install the altimeter bracket first, otherwise, access to the mounting points on the drone might be obscured later on during the assembly

1. Attach altimeter mounting bracket to the body of the drone below.



**Note** If the built in gimbal is in the way of the mounting points, you can slide it all the way back.

2. Attach the dovetail cable on the gimbal.



3. Attach the SkyHub on the leg of the drone.



4. Plug in the drone link cable (Red) to the third connector (Red) on the SkyHub.



5. Plug the power cable into the first power port on SkyHub.



6. Physical assembly of the SkyHub is complete. Check that all the connectors are secured tightly, with no loose movements.

### 9.6.1 Altimeter installation on the drone and connection to the SkyHub

To install the altimeter sensor on the IF800 Tomcat, use the mountings provided with the sensor.

---

**Note** At this points, mounting bracket should be already installed on the drone.

---

For your convenience, we have a library with 3D models you can download and print yourself in case the default ones are broken or missing: <https://files.ugcs.com/s/fMpj5LJpobWeMFj>

1. Slide the altimeter vertically on the previously attached bracket.



2. Adjust the altimeter position by rotating it downwards or upwards.



---

**Note** If you wish to detach the sensor, simply perform the same action in reverse. Place the altimeter in the vertical position and slide it up from the gimbal.

---

3. Connect the cable to Connector 1 (yellow) on the SkyHub.



4. Setup is complete. You can now proceed with the widget configuration.

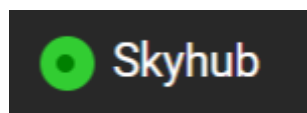
### 9.6.2 Altimeter / Autopilot configuration within the CPM software

Before proceeding further, power on both the drone and remote controller. Then, make sure that your computer and the controller are connected to the same network. This is required to establish the drone link connection between CPM on your computer and SkyHub on the drone.

---

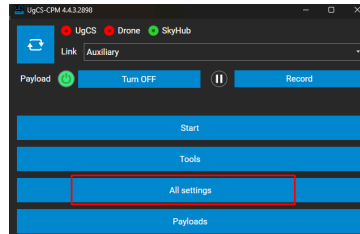
**Note** SkyHub will take a little more time to fully boot up. You can check whether it is ready by the indicator within CPM. As soon as the SkyHub indicator becomes green, you can proceed with the configuration.

---

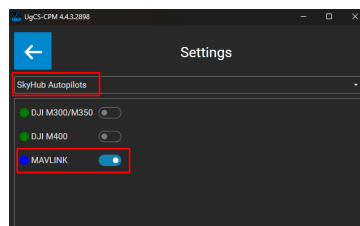


## 9.7 Enabling the autopilot

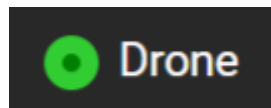
1. Press the “All settings” button.



2. From the drop-down list, select the “SkyHub Autopilots” section.
3. Enable MAVLINK (note that only one autopilot can be enabled at a time). Press Save and perform a system restart.



Autopilot configuration is complete. After the system restart, you will notice that the drone link icon should become green.

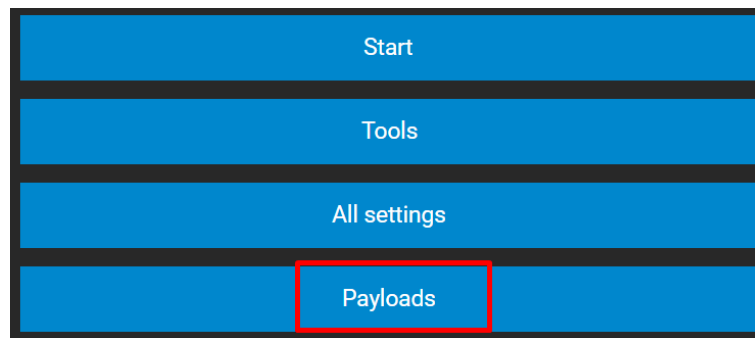


## 9.8 Enabling the altimeter

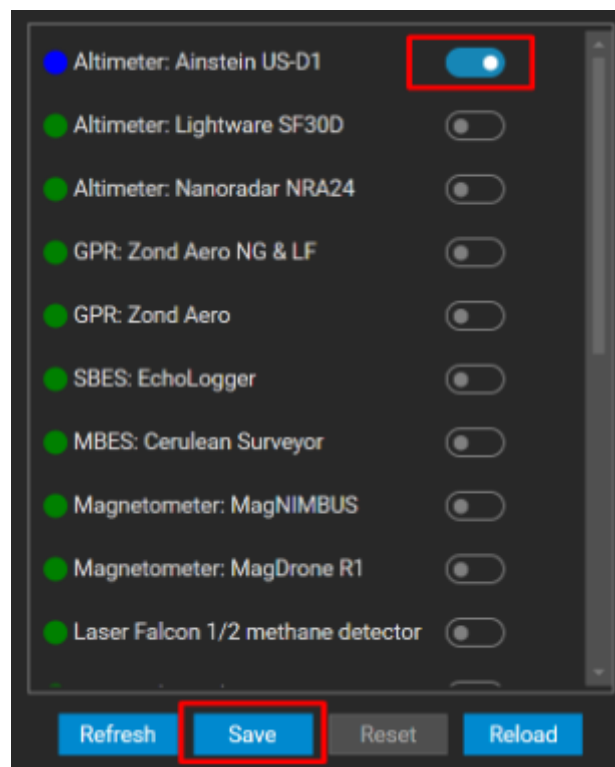
When both drone link and SkyHub connections are established, you can proceed with the altimeter widget configuration.

1. Click on the Payloads section

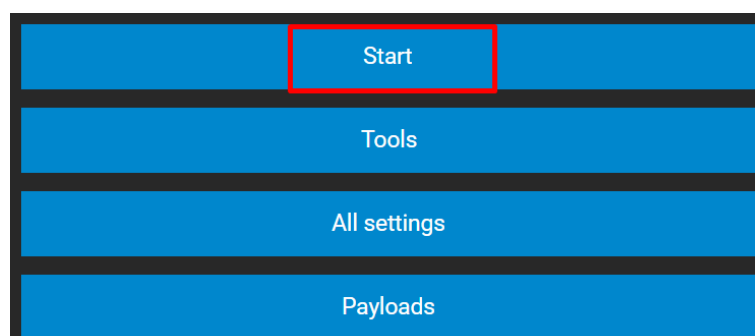




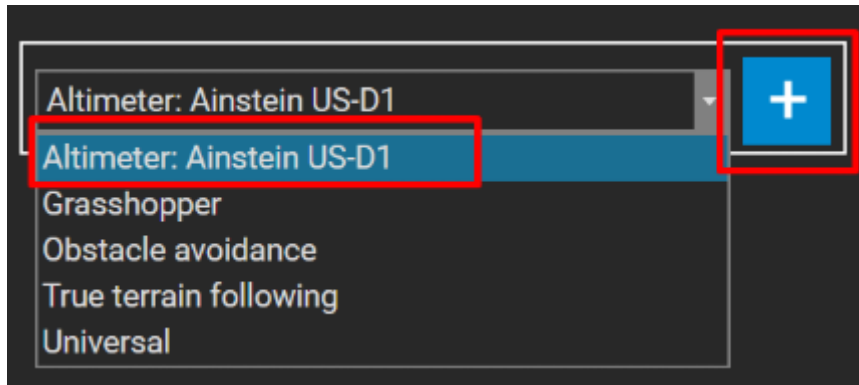
2. From the payload list, search for your altimeter model (in our example, it is US-D1), enable it, and press the Save button. Perform a system restart.



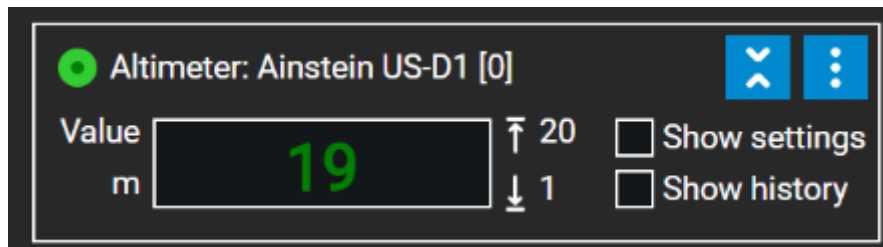
3. After the restart is complete, press the Start button.



- From the drop-down list, select the altimeter model you enabled previously and press the “plus” icon



Widget configuration is complete. If everything was set up correctly, you should see the initial readings from the sensor.



## 9.9 VSM configuration

- First, navigate to the VSM configuration file.

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**Note** Microsoft Windows: C:\Program Files (x86)\UgCS\bin\vsm-mavlink.conf

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**Note** GNU/Linux: /etc/opt/ugcs/vsm-mavlink.conf

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**Note** Apple OS X: /Users/[user name]/Library/Application Support/UGCS/configuration/vsm-mavlink.conf

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|                                                                                   |                         |           |             |   |
|-----------------------------------------------------------------------------------|-------------------------|-----------|-------------|---|
|  | apm_telemetry.conf      | 724 bytes | 3 weeks ago | ☆ |
|  | apm_telemetry.conf.orig | 724 bytes | 3 weeks ago | ☆ |
|  | libcrypto-1_1-x64.dll   | 2.8 MB    | 2 years ago | ☆ |
|  | libgcc_s_seh-1.dll      | 74.2 kB   | 8 years ago | ☆ |
|  | libssl-1_1-x64.dll      | 582.4 kB  | 2 years ago | ☆ |
|  | libstdc++-6.dll         | 1.4 MB    | 8 years ago | ☆ |
|  | libwinpthread-1.dll     | 51.7 kB   | 8 years ago | ☆ |
|  | vsm-mavlink.conf        | 11.1 kB   | 2 weeks ago | ☆ |
|  | vsm-mavlink.conf.orig   | 11.1 kB   | Last week   | ☆ |
|  | vsm-mavlink.exe         | 2.6 MB    | 3 weeks ago | ☆ |

2. Open the configuration file with any text editor and uncomment the line: **vehicle.ardupilot.parameter.WP\_YAW\_BEHAVIOR = 1**

```
# Set WP_YAW_BEHAVIOR Ardupilot parameter.
# Valid only for copters.
# Specify yaw behavior:
# 0 Yaw controlled by mission via Heading WP action.
# 1 Face next waypoint
# 2 Face next waypoint except RTL
# 3 Face along GPS course
# Route upload will overwrite this setting with 0 if vehicle.ardupilot.autoheading is set to yes.
vehicle.ardupilot.parameter.WP_YAW_BEHAVIOR = 1
```

3. Change the value of **vehicle.ardupilot.autoheading** to **no**

```
# Set heading to next waypoint.
# no - do not change heading between waypoints. This disables override of parameter WP_YAW_BEHAVIOR on mission upload.
# yes - change heading towards next waypoint. When set, each mission upload sets WP_YAW_BEHAVIOR to zero (yaw controlled by mission)
# Default: yes
vehicle.ardupilot.autoheading = no
```

4. Save the changes.



---

## Quick Start: ArduPilot

---

### 10.1 Hardware requirements

- SkyHub v3 device.
- Drone running ArduPilot flight controller with firmware 4.\* or higher.
- Mounting parts to install SkyHub.
- SkyHub3 cable for Pixhawk autopilot or cable provided by drone manufacturer to connect SkyHub with autopilot.
- Power output (according to SkyHub required input power).

### 10.2 Software requirements for the Windows PC

- UgCS v5.13.0 or higher (referred to below as **UgCS**)
- UgCS Custom Payload Monitor v4.3.0 or higher (referred to below as **UgCS-CPM**)
- MissionPlanner for ArduPilot configuration.
- WinSCP (optional) to access SkyHub file system for advanced configuration.

#### 10.2.1 UgCS desktop download and setup process

1. Download the installation package: <https://www.sphengineering.com/flight-planning/ugcs-downloads>
2. Run the setup file.
3. Read and acknowledge the license agreement.
4. In the component selection tab, select ArduPilot to install necessary autopilot compatibility.

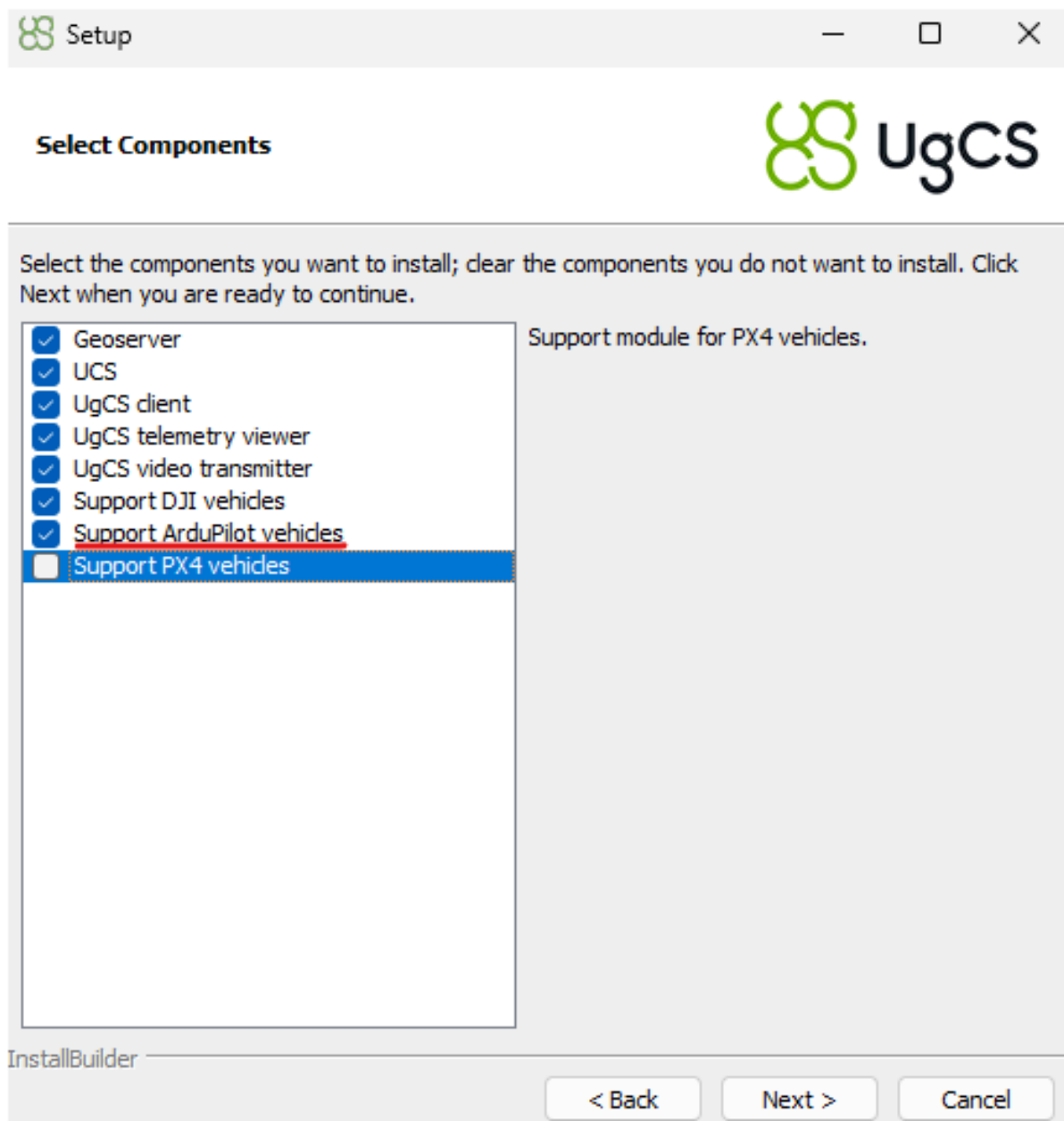
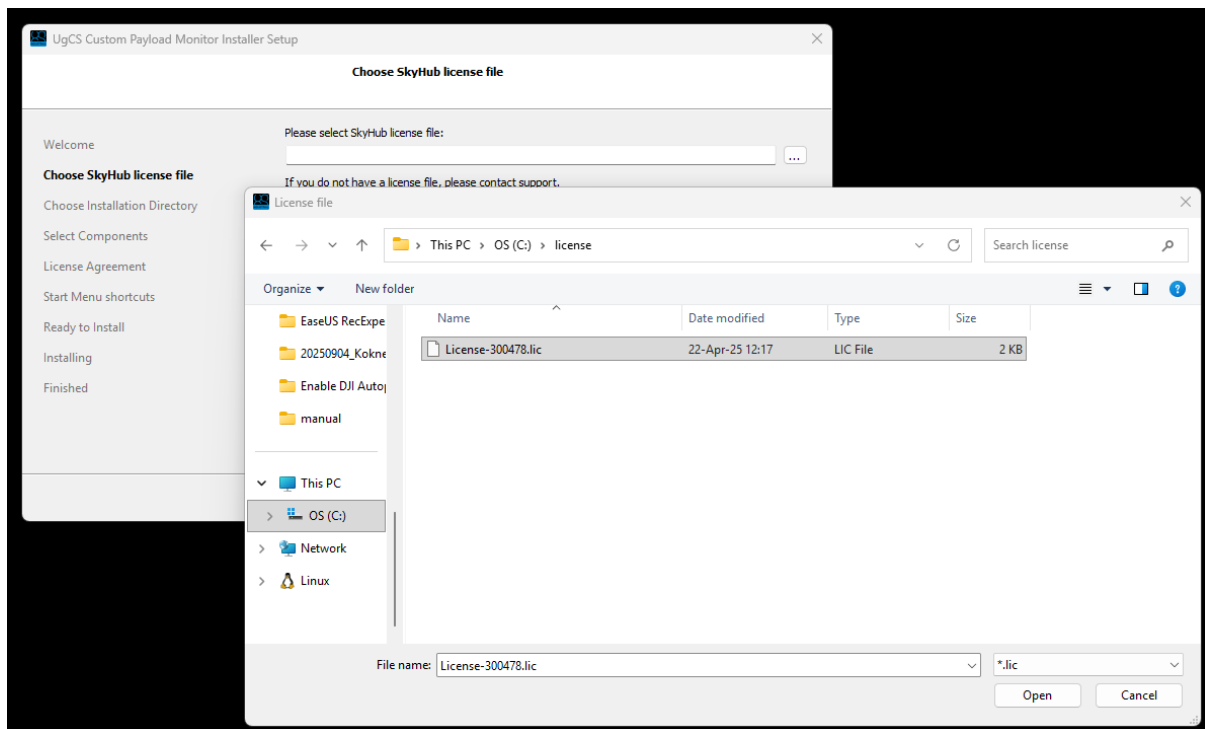


Figure 10.1. ArduPilot compatibility in UgCS setup

5. Installation complete.

### 10.2.2 UgCS Custom Payload Monitor download and setup process

1. Download the latest available CPM version here: <https://www.sphengineering.com/integrated-systems/-downloads>
2. Run the setup file.
3. Select the SkyHub license file for the SkyHub you will be using.



4. Read and acknowledge the license agreement.
5. Installation complete.

**Note** If you do not have a license file or need a new one, please reach out to us at [support@ugcs.com](mailto:support@ugcs.com) and provide your SkyHub serial number.

## 10.3 SkyHub installation on the drone

### 10.3.1 Physical setup

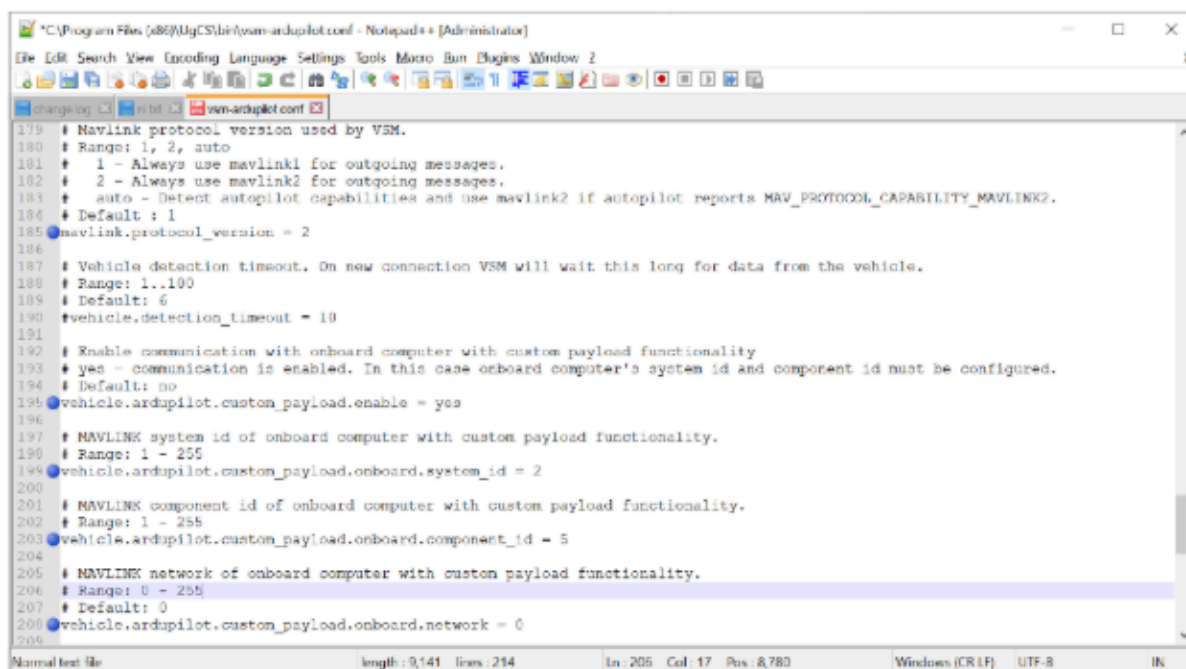
**Warning** Power off the system when connecting cables. To avoid short-circuiting or causing potentially harmful power fluctuations, it is recommended to power off the entire system before performing any cable plug-in or unplugging. Some of the payload sensors used are extremely sensitive to power changes and may be damaged.

1. Mount SkyHub on the drone in a safe, fixed position.
2. Connect SkyHub Connector #3 (red) to the flight controller using the SkyHub 3 cable for Pixhawk autopilot (or cable provided by drone manufacturer).
3. Connect SkyHub to a power source.

### 10.3.2 UgCS configuration

1. Make sure UgCS version 5.10.2 or higher is used (download links can be found in Prerequisites section) and VSM for ArduPilot vehicles is installed.
2. Configure UgCS ArduPilot VSM. Open `vsm-ardupilot.conf` in a text editor with administrator privileges. The file is located in the UgCS installation folder (default path `C:\Program Files (x86)\UgCSbin`). Find,

uncomment, and adjust the following settings if needed.



```

179 # MAVLink protocol version used by VSM.
180 # Range: 1, 2, auto
181 # 1 - Always use mavlink1 for outgoing messages.
182 # 2 - Always use mavlink2 for outgoing messages.
183 # auto - Detect autopilot capabilities and use mavlink2 if autopilot reports MAV_PROTOCOL_CAPABILITY_MAVLINK2.
184 # Default : 1
185 # mavlink.protocol_version = 2
186
187 # Vehicle detection timeout. On new connection VSM will wait this long for data from the vehicle.
188 # Range: 1..100
189 # Default: 6
190 # vehicle.detection_timeout = 10
191
192 # Enable communication with onboard computer with custom payload functionality
193 # yes - communication is enabled. In this case onboard computer's system id and component id must be configured.
194 # Default: no
195 # vehicle.ardupilot.custom_payload.enable = yes
196
197 # MAVLINK system id of onboard computer with custom payload functionality.
198 # Range: 1 - 255
199 # vehicle.ardupilot.custom_payload.onboard.system_id = 2
200
201 # MAVLINK component id of onboard computer with custom payload functionality.
202 # Range: 1 - 255
203 # vehicle.ardupilot.custom_payload.onboard.component_id = 5
204
205 # MAVLINK network of onboard computer with custom payload functionality.
206 # Range: 0 - 255
207 # Default: 0
208 # vehicle.ardupilot.custom_payload.onboard.network = 0
209

```

Figure 10.2. ArduPilot VSM configuration

1. Establish Auxiliary connection between UgCS-CPM and SkyHub. See [Preparation](#) guide for instructions.
2. When Auxiliary link is established, you should select it from the Link menu in UgCS-CPM.

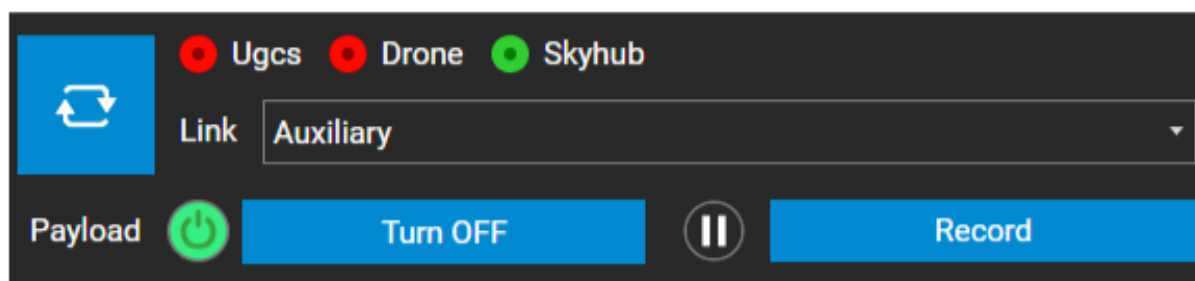


Figure 10.3. Auxiliary Link settings in UgCS-CPM

**Note** The following functionalities are available when SkyHub is connected via the Auxiliary link:

- Widget configuration in UgCS-CPM.
- Data from payload in widgets.
- Data download from SkyHub.
- Firmware upgrade.
- SkyHub configuration.

5. ArduPilot configuration for SkyHub - On the autopilot, it is necessary to configure the serial port to which SkyHub will be connected.

Parameters:

```
SERIALx_BAUD 230400  
SERIALx_PROTOCOL 2 MAVLink2
```

#### 6. Enabling MAVLink autopilot on SkyHub

In CPM, press the Settings button, choose SkyHub Autopilots from the menu and enable MAVLink. Press Save and choose to reload the system to apply changes.

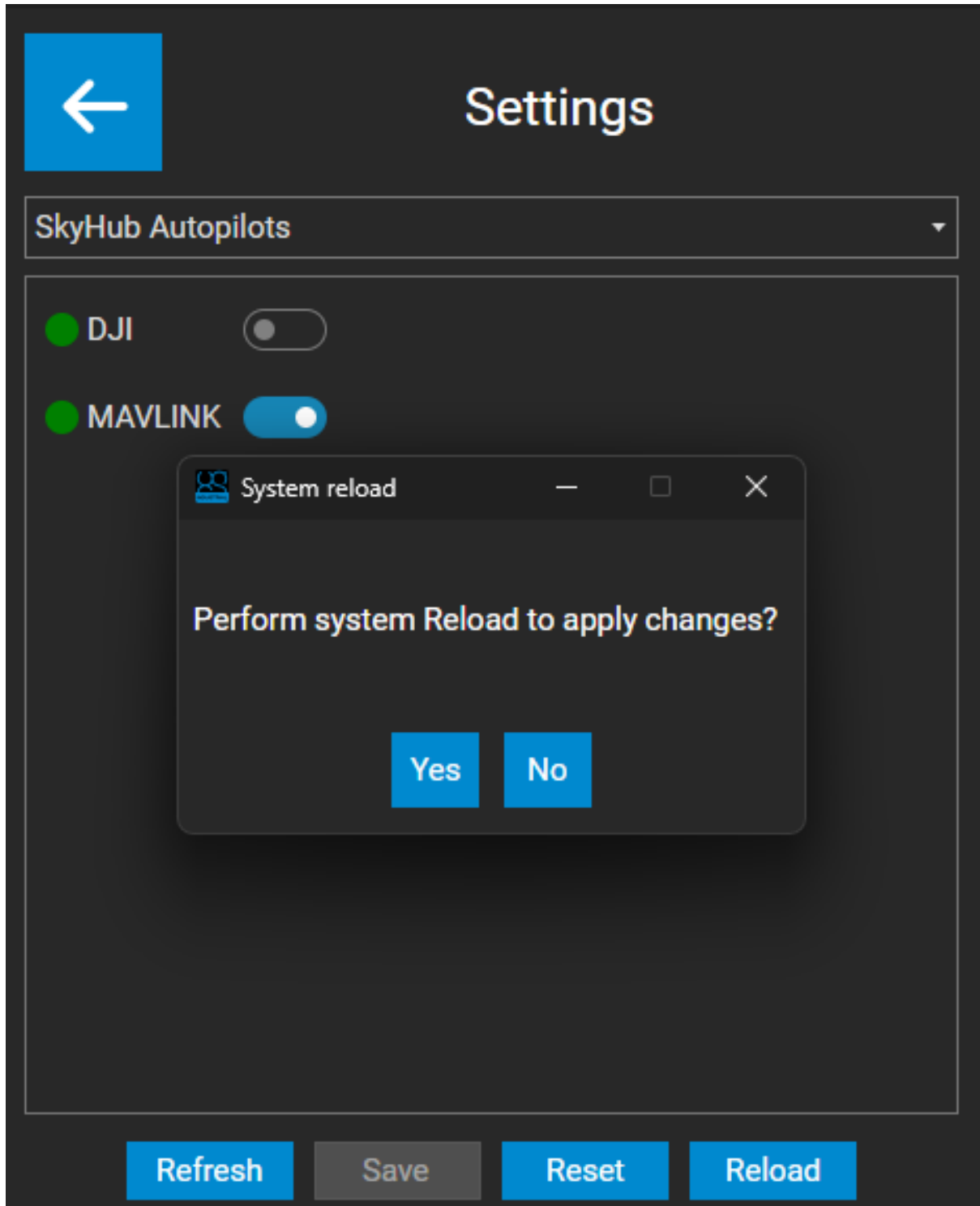


Figure 10.4. Enabling MAVlink in UgCS-CPM

If the configuration on the autopilot matches the default settings on SkyHub, the drone connection indicator in UgCS-CPM must turn green.

7. Verify connection on ArduPilot using Mission Planner. In Mission Planner, open Setup -> Advanced -> MAVLink inspector.

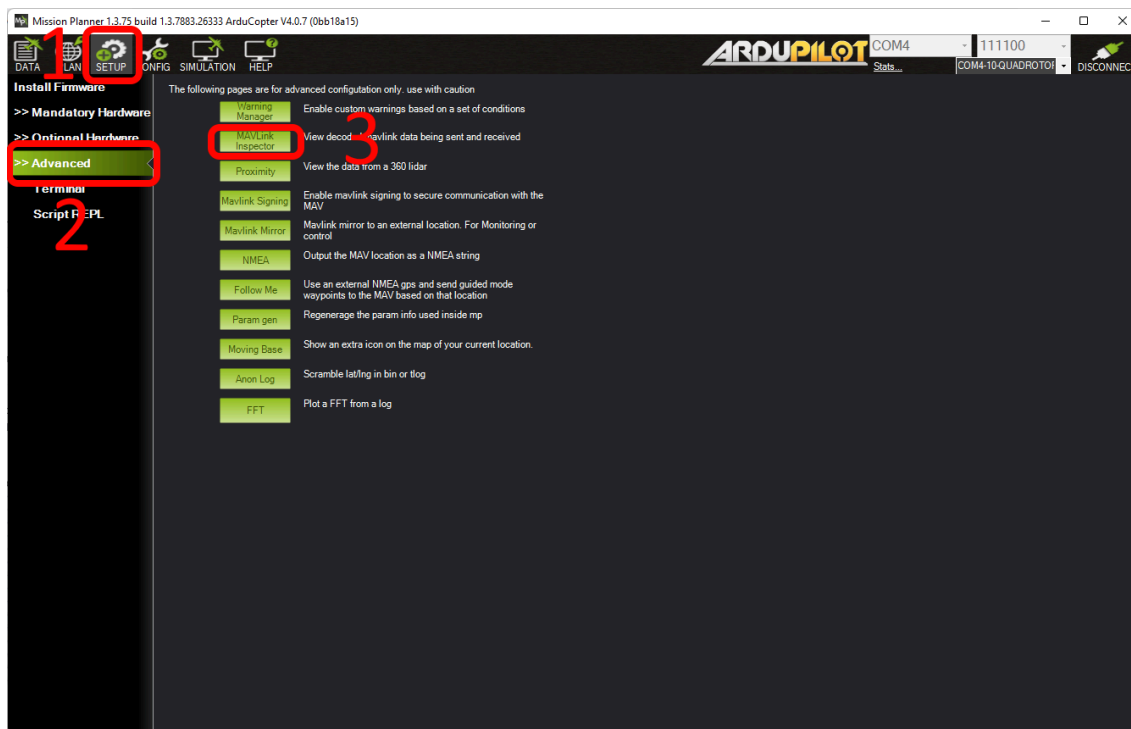


Figure 10.5. Mission Planner MAVlink inspector

8. In case of correct connection and configuration, the MAVLink inspector shows communication between SkyHub and the autopilot.

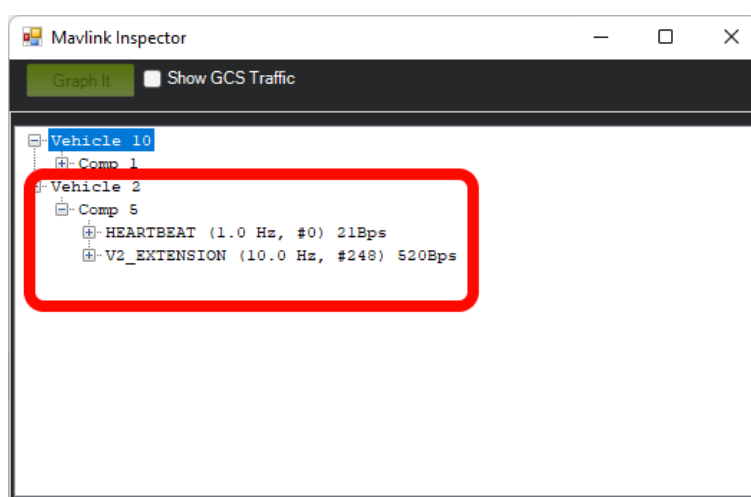


Figure 10.6. Mission Planner MAVlink inspector data

Vehicle 2 and Comp 5 correspond to the configured SkyHub System (2) and Component (5) ID.

9. In case of correct autopilot, UgCS, and SkyHub configuration, Payload data b64 is displayed in the drone

telemetry in UgCS.

## 10.4 Altimeter setup

**Note** There are two possible ways how the Altimeter can be attached to the Arudpilot drones:

1. Connected to the SkyHub Connector #1.
2. Connected directly to the drone.

### 10.4.1 When Altimeter is connected to SkyHub

1. Connect the altimeter to the SkyHub Connector #1 (yellow).
2. Navigate to the “Payload” section.
3. Enable the driver for the Altimeter you will use, and confirm the reload.

**Note** In this example, we will use US-D1 model.

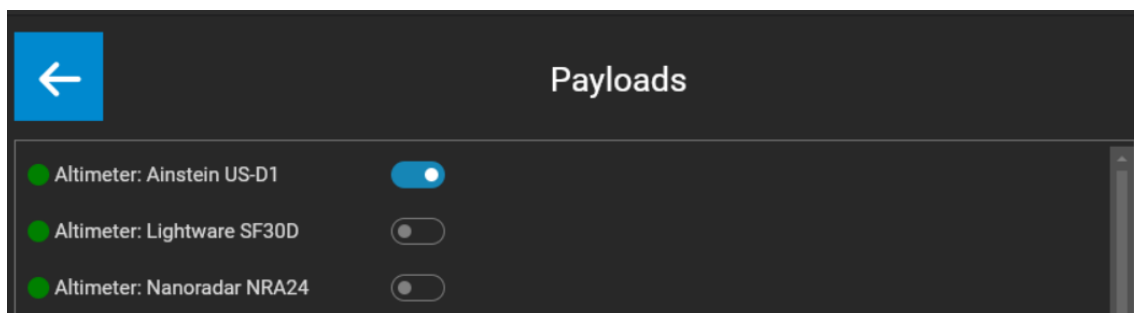


Figure 10.7. US-D1 driver enabled

4. Next, in the UgCS-CPM software, navigate to the “All settings” section.
5. From the drop-down list select “Mavlink settings”.
6. Make sure that “Use SkyHub altimeter” option is enabled.
7. Make sure that “Use drone altimeter” option is disabled.
8. Click “Save” button and confirm reload.

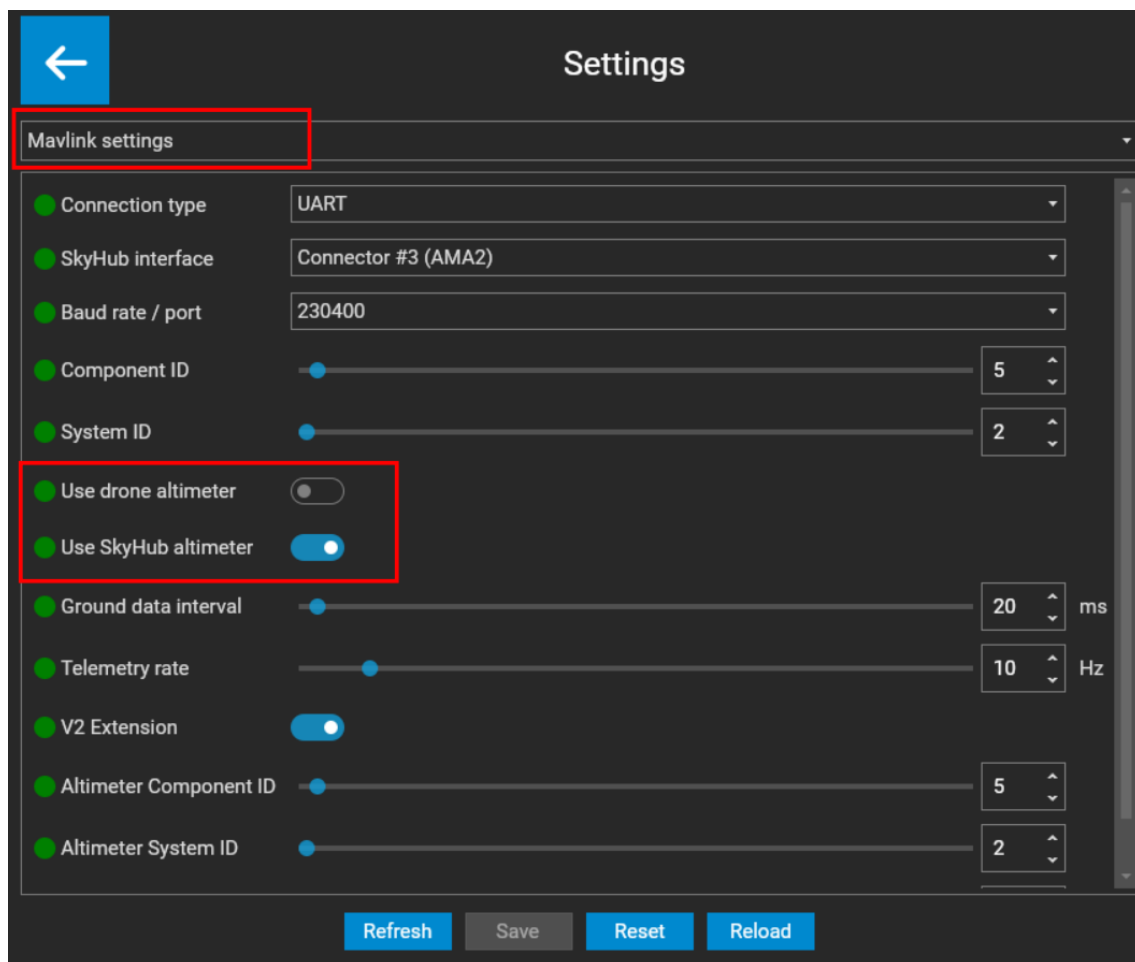


Figure 10.8. Altimeter toggles

9. Click on the drop-down list once more, and select the “Altimeters” section.
10. Set the default altimeter to your model (in our example, Einstein US-D1). Click “Save” and confirm reload.



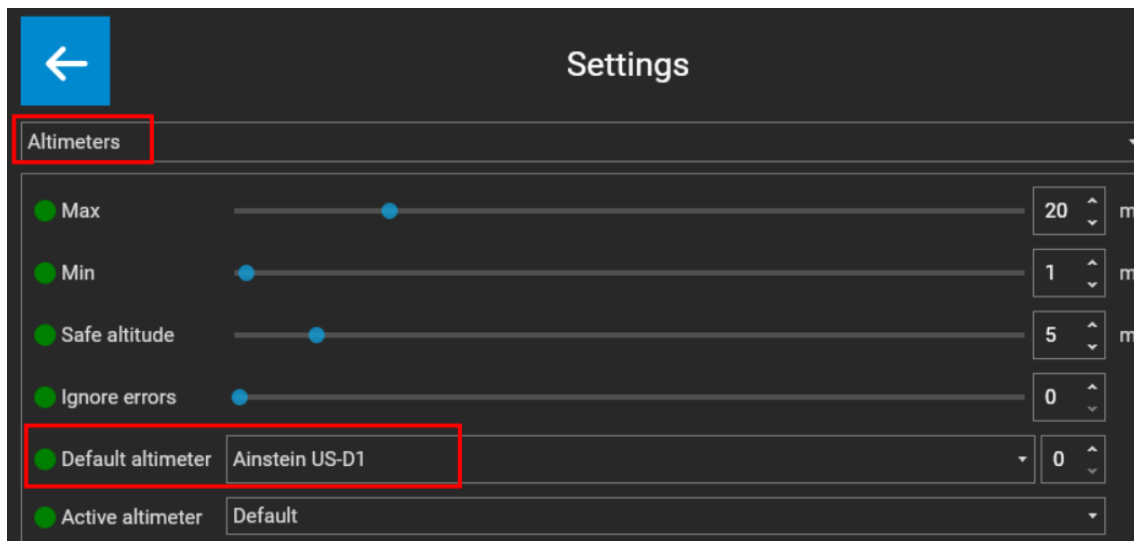


Figure 10.9. Default altimeter Ainstein

11. Go back to the main menu and click “Start” button.
12. From the drop-down list select your altimeter (in our example it is “Altimeter:Ainstein US-D1”) and press the “+” button.

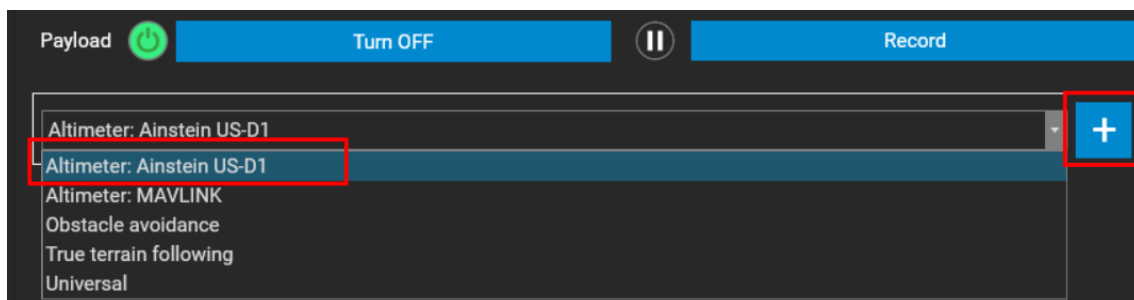


Figure 10.10. Altimeter: Ainstein US-D1 widget

13. Altimeter configuration is complete.

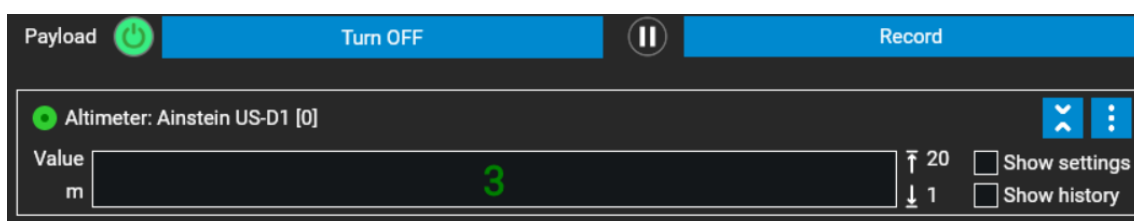


Figure 10.11. Widget is ready

### 10.4.2 When Altimeter is connected directly to the drone

1. Connect the altimeter to your drone.
2. In the UgCS-CPM software, navigate to the “All settings” section.

3. From the drop-down list select “Mavlink settings”
4. Make sure that “Use SkyHub altimeter” option is enabled.
5. Make sure that “Use drone altimeter” option is enabled.
6. Click “Save” button and confirm reload.

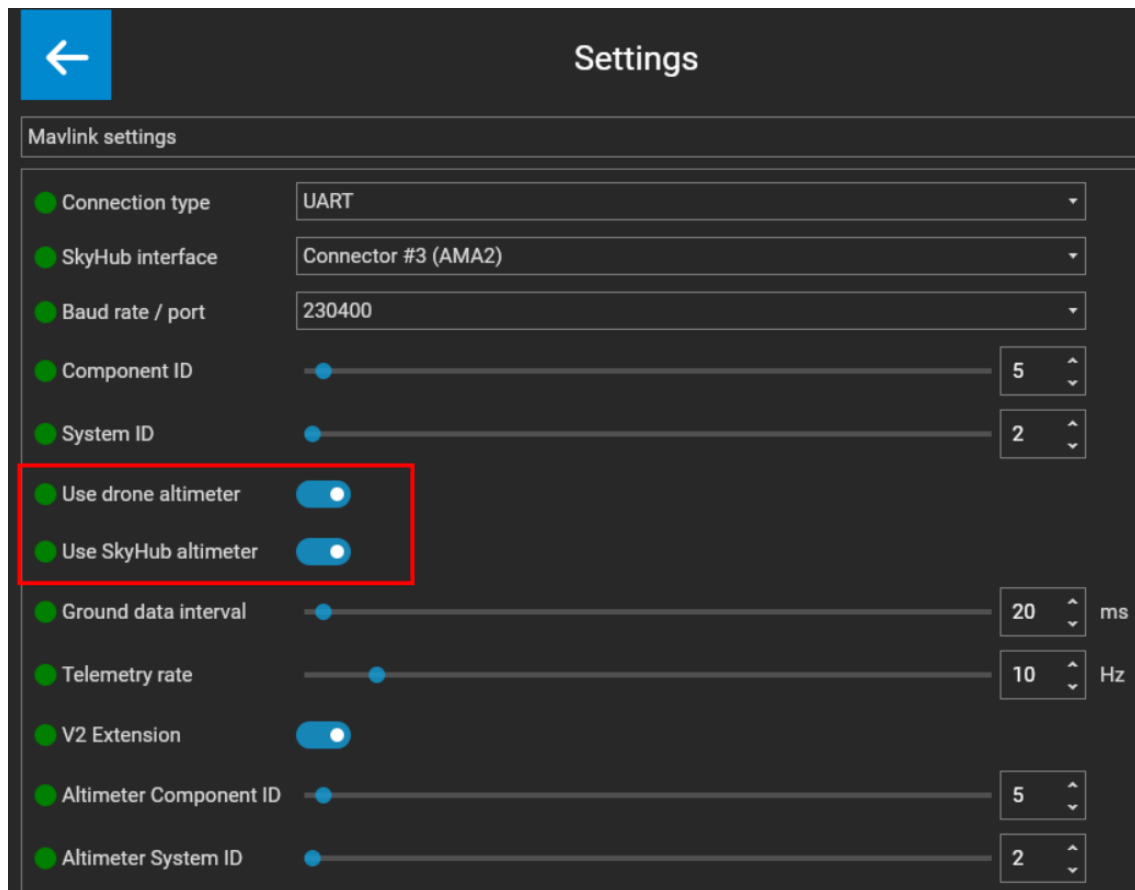


Figure 10.12. Altimeter toggles

7. Click on the drop-down list once more, and select the “Altimeters” section.
8. Set the default altimeter to “Mavlink (autopilot)”. Click “Save” and confirm reload.



Figure 10.13. Default altimeter Mavlink

- 9. Go back to the main menu and click “Start” button.
- 10. From the drop-down list select “Altimeter: MAVLINK” and press the “+” button.

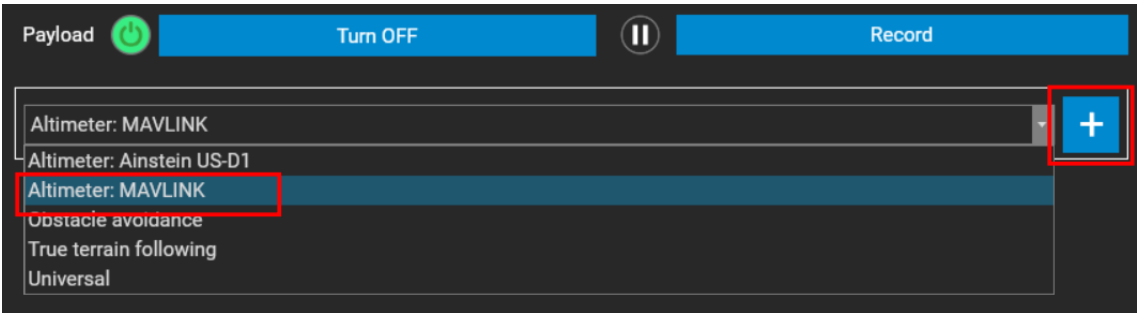


Figure 10.14. Altimeter MAVLINK

- 11. Altimeter configuration is complete.

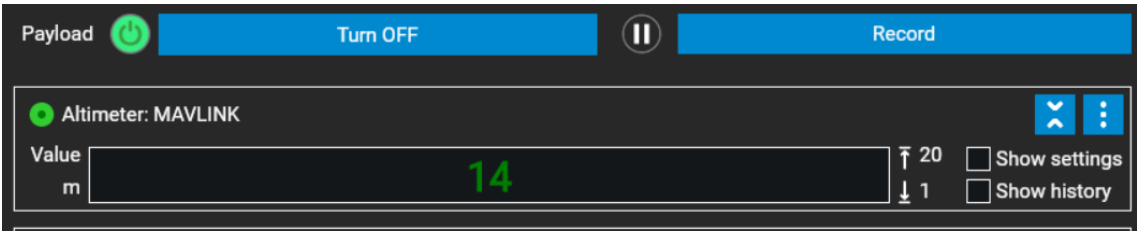


Figure 10.15. Widget is ready



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## Quick Start: PX4

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**Note** SkyHub does not support True Terrain following with PX4. SkyHub works only as data logger for payload sensor using position data from PX4 autopilot.

Connection with SkyHub during the flight can be established only if UgCS desktop is used as ground control software.

---

### 11.1 Hardware requirements

- SkyHub v3 device.
- Drone running PX4 flight controller with firmware version 1.7+
- Mounting parts to install SkyHub.
- [SkyHub3 cable for Pixhawk autopilot](#) or cable provided by drone manufacturer to connect SkyHub with autopilot.
- Power output (according to SkyHub required input power).

### 11.2 Software requirements for the Windows PC

- UgCS v5.13.0 or higher (referred to below as **UgCS**)
- [UgCS Custom Payload Monitor v4.3.0 or higher](#) (referred to below as **UgCS-CPM**)
- [QGroundControl](#) for the PX4 configuration.
- [WinSCP \(optional\)](#) to access SkyHub file system for advanced configuration.

#### 11.2.1 UgCS desktop download and setup process

1. Download the installation package: <https://www.sphengineering.com/flight-planning/ugcs-downloads>
2. Run the setup file.
3. Read and acknowledge the license agreement.
4. In the component selection tab, select ArduPilot to install necessary autopilot compatibility.

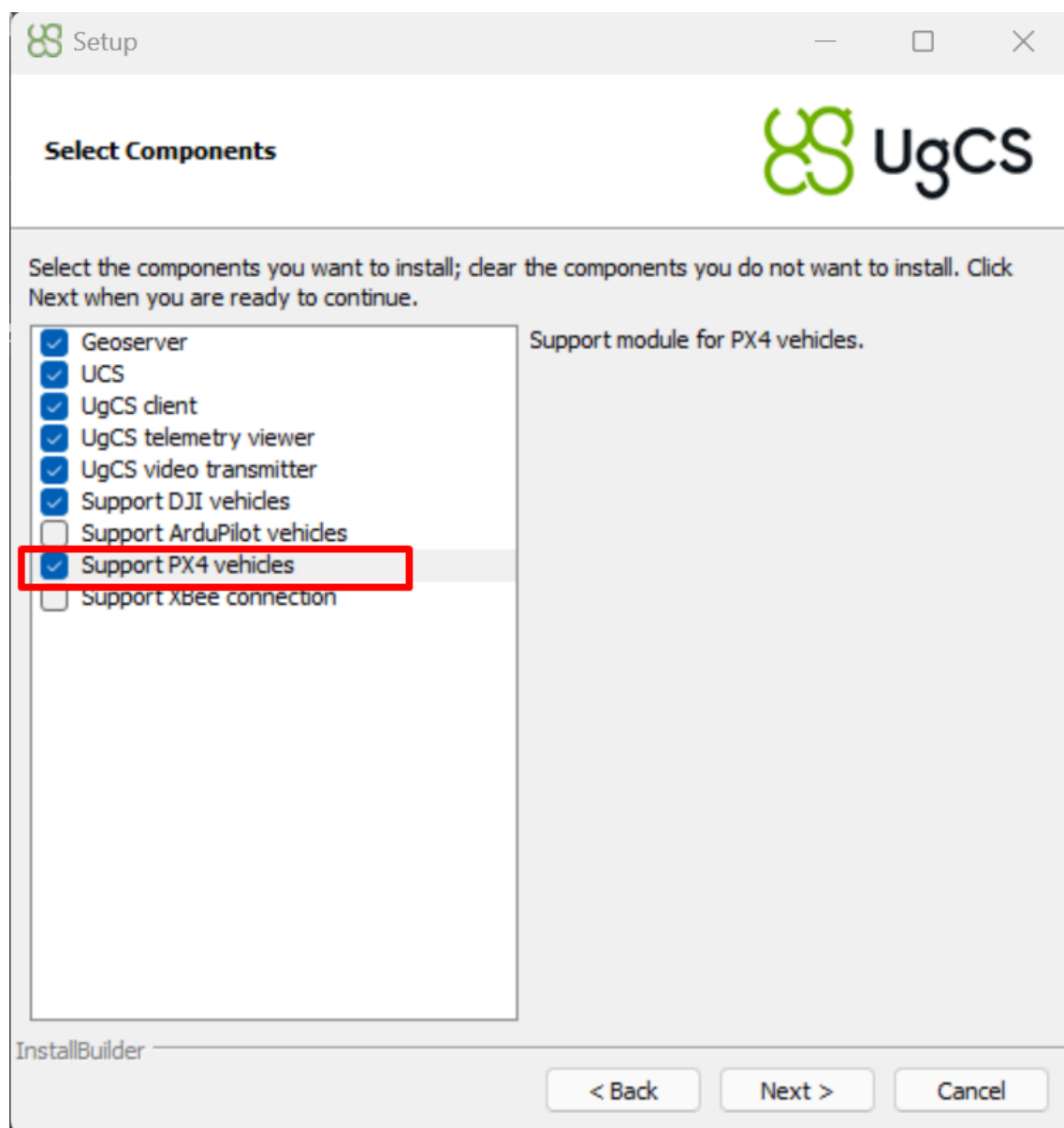
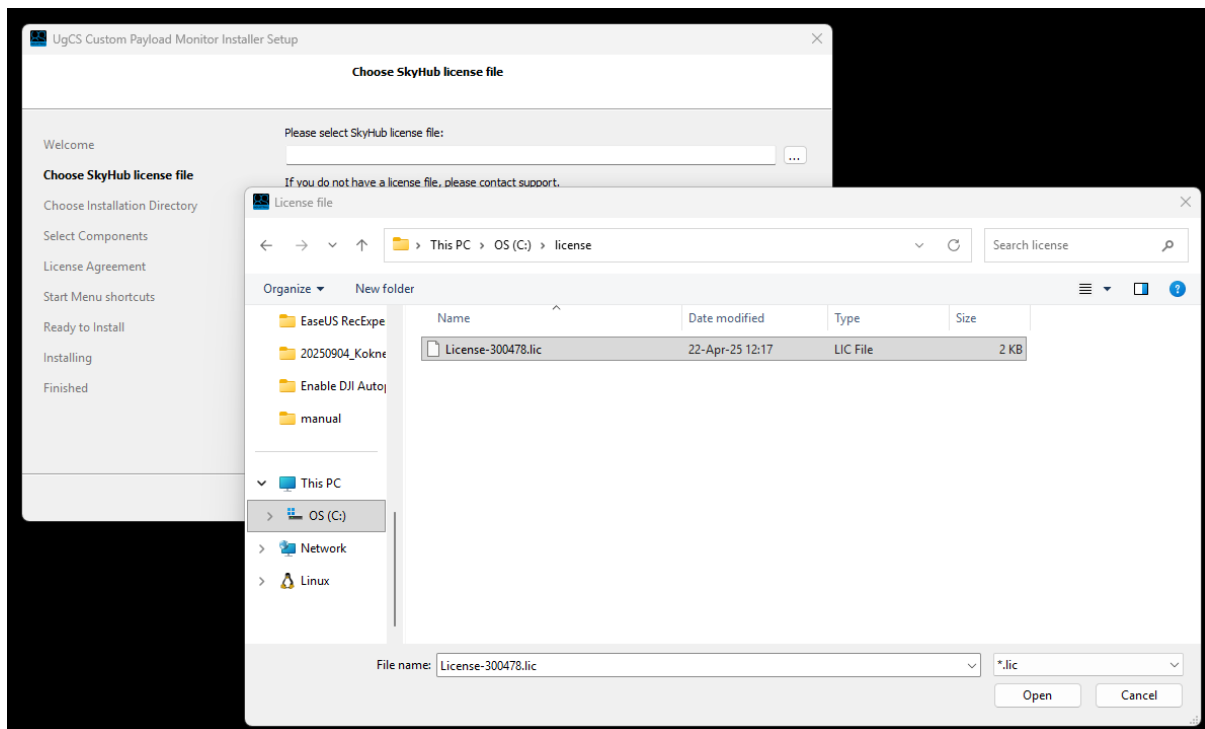


Figure 11.1. PX4 VSM in UgCS setup

5. Installation complete.

### 11.2.2 UgCS Custom Payload Monitor download and setup process

1. Download the latest available CPM version here: <https://www.sphengineering.com/integrated-systems/-downloads>
2. Run the setup file.
3. Select the SkyHub license file for the SkyHub you will be using.



4. Read and acknowledge the license agreement.
5. Installation complete.

**Note** If you do not have a license file or need a new one, please reach out to us at [support@ugcs.com](mailto:support@ugcs.com) and provide your SkyHub serial number.

## 11.3 SkyHub installation on the drone

### 11.3.1 Physical setup

**Warning** Power off the system when connecting cables. To avoid short-circuiting or causing potentially harmful power fluctuations, it is recommended to power off the entire system before performing any cable plug-in or unplugging. Some of the payload sensors used are extremely sensitive to power changes and may be damaged.

1. Mount SkyHub on the drone in a safe, fixed position.
2. Connect SkyHub Connector #3 (red) to the flight controller using the SkyHub 3 cable for Pixhawk autopilot.
3. Connect SkyHub to a power source.

### 11.3.2 Autopilot configuration

1. Make sure UgCS version 5.13 or higher is used (download links can be found in Prerequisites section) and VSM for PX4 vehicles is installed.
2. Establish Auxiliary connection between UgCS-CPM and SkyHub. See [Preparation](#) guide for instructions.

3. When Auxiliary link is established, you should select it from the Link menu in UgCS-CPM.

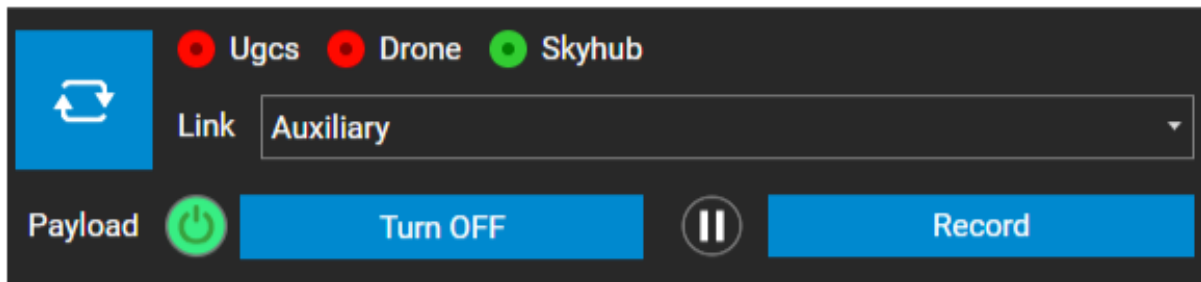


Figure 11.2. Auxiliary Link settings in UgCS-CPM

---

**Note** The following functionalities are available when SkyHub is connected via the Auxiliary link:

- Widget configuration in UgCS-CPM.
- Data from payload in widgets.
- Data download from SkyHub.
- Firmware upgrade.
- SkyHub configuration.

---

4. Enable MAVLink autopilot on SkyHub.

In UgCS-CPM, press the “Settings” button, choose “SkyHub Autopilots” from the menu and enable “MAVLink”. Press Save and choose to reload the system to apply changes.



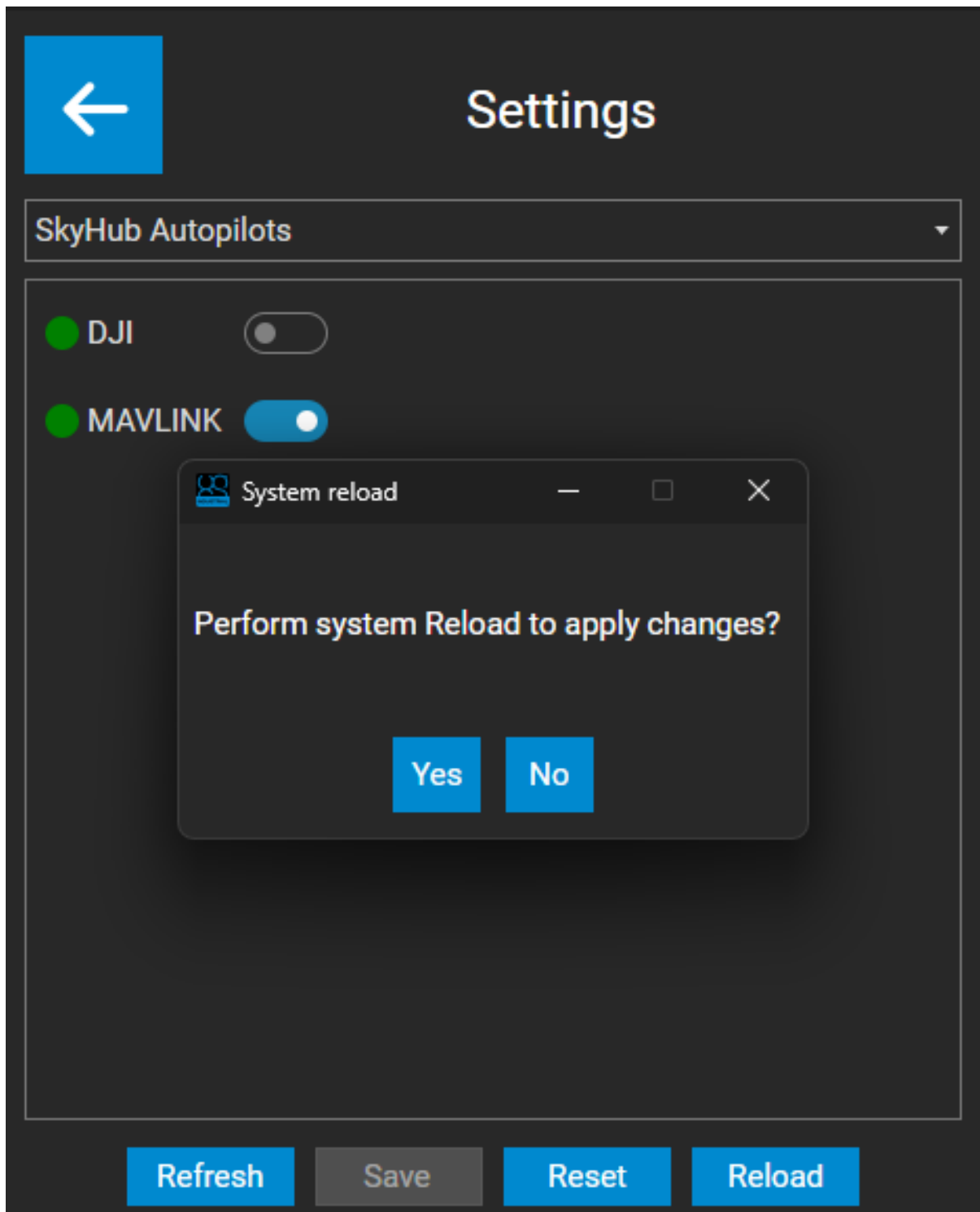


Figure 11.3. Enabling MAVlink in UgCS-CPM

6. Restart SkyHub.
7. Make sure that the UgCS PX4 VSM parameter `vehicle.px4.custom_payload.onboard.component_id` is equal to the Component ID value in the MAVLink settings within the UgCS-CPM.
8. Make sure that the V2 Extension parameter is enabled.

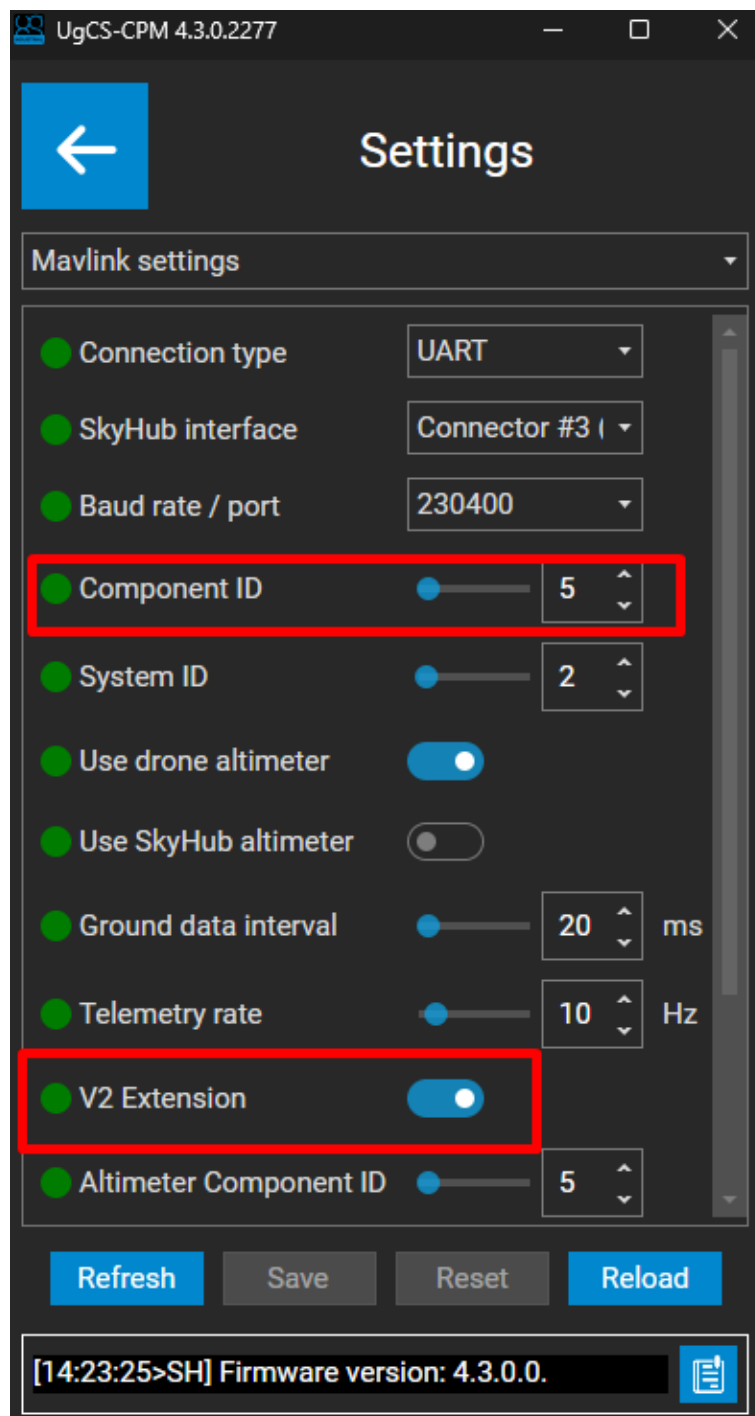


Figure 11.4. MAVLINK settings

9. If SkyHub is connected to telemetry port 2, open the QGroundControl application, then go to Parameters -> MAVLink and set the parameter MAV\_1\_CONFIG to TELEM2.

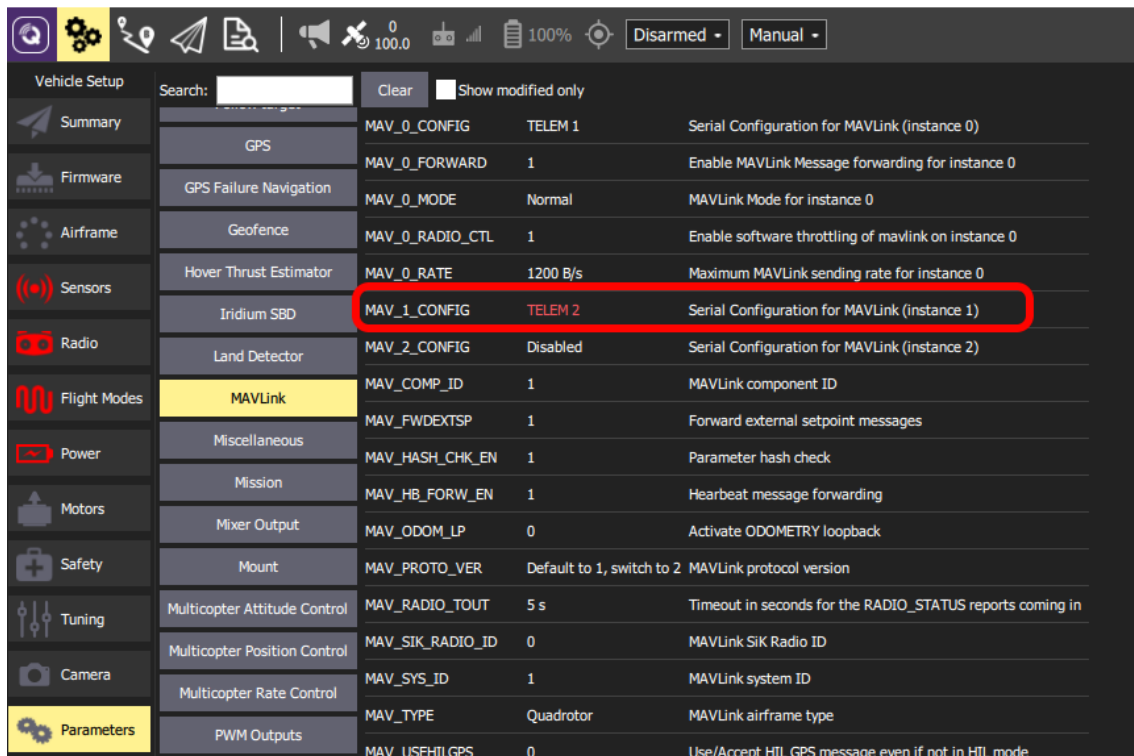


Figure 11.5. SkyHub PX4 TELEM2 port configuration

10. Restart the autopilot.
11. After restart, data forwarding for TELEM2 autopilot telemetry ports should be enabled. Set the parameter MAV\_1\_FORWARD to 1.

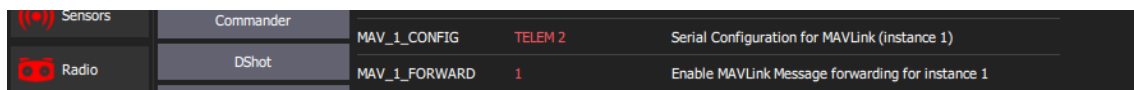


Figure 11.6. SkyHub PX4 TELEM2 port data forwarding configuration

12. Change the baud rate for the TELEM2 Serial Port (recommended 230400). Speed should be the same as configured on the SkyHub side in the MAVLink settings within the UgCS-CPM.

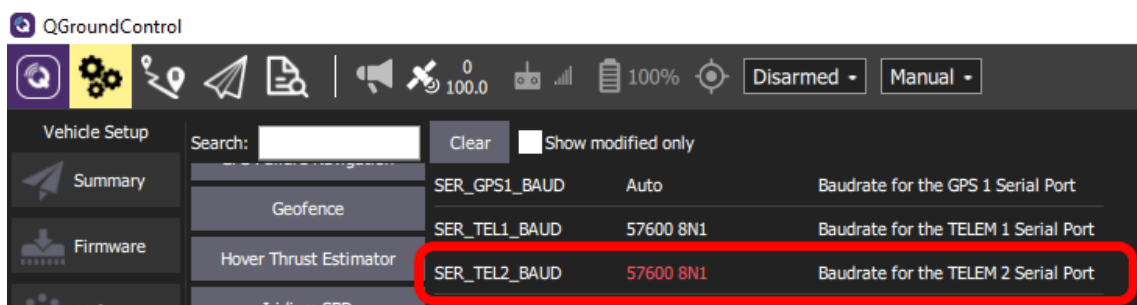


Figure 11.7. SkyHub PX4 TELEM2 port baudrate configuration

**Note** SkyHub subscribes to the following MAVLink messages with telemetry rate defined by the Telemetry

rate parameter in the MAVLink settings within the UgCS-CPM:

GPS2\_RAW; GPS\_RAW\_INT; GLOBAL\_POSITION\_INT; ATTITUDE; SYSTEM\_TIME; HEARTBEAT;  
DISTANCE\_SENSOR

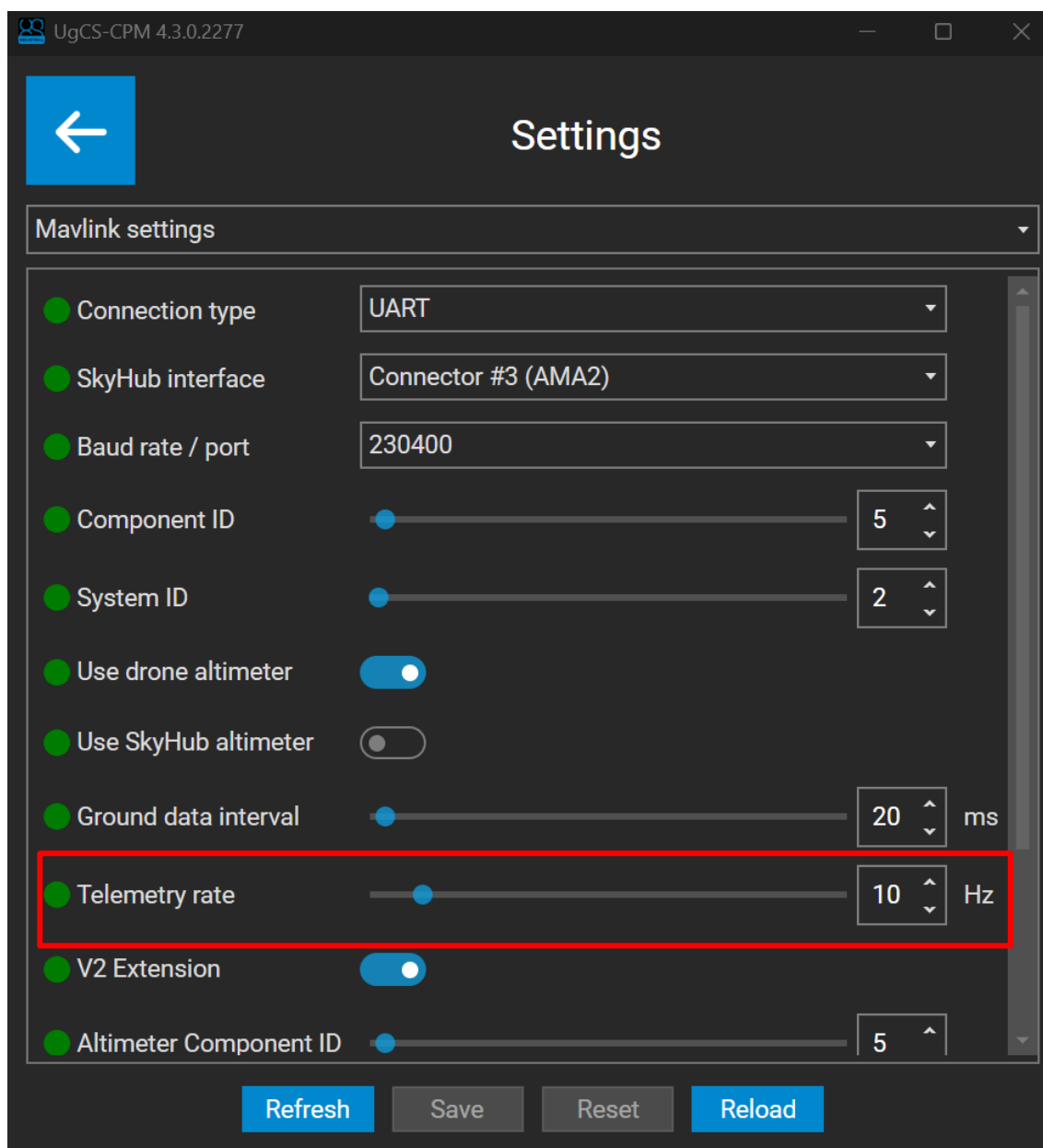


Figure 11.8. Mavlink telemetry rate

## 11.4 Altimeter setup

**Warning** SkyHub does not support True Terrain Following on PX4. Altimeter readings are shown in the widget purely as a visual reference and have no effect on flight control.

There are two possible ways how the Altimeter can be attached to the PX4 drones:

1. Connected to the SkyHub Connector #1.

2. Connected directly to the drone.

### 11.4.1 When Altimeter is connected to SkyHub

1. Connect the altimeter to the SkyHub Connector #1 (yellow).
2. Navigate to the “Payload” section.
3. Enable the driver for the Altimeter you will use, and confirm the reload.

---

**Note** In this example, we will use US-D1 model.

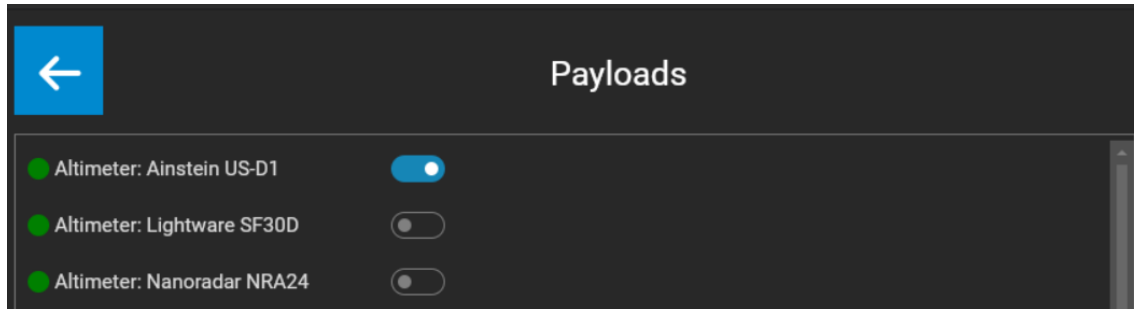


Figure 11.9. US-D1 driver enabled

4. Next, in the UgCS-CPM software, navigate to the “All settings” section.
5. From the drop-down list select “Mavlink settings”.
6. Make sure that “Use SkyHub altimeter” option is enabled.
7. Make sure that “Use drone altimeter” option is disabled.
8. Click “Save” button and confirm reload.

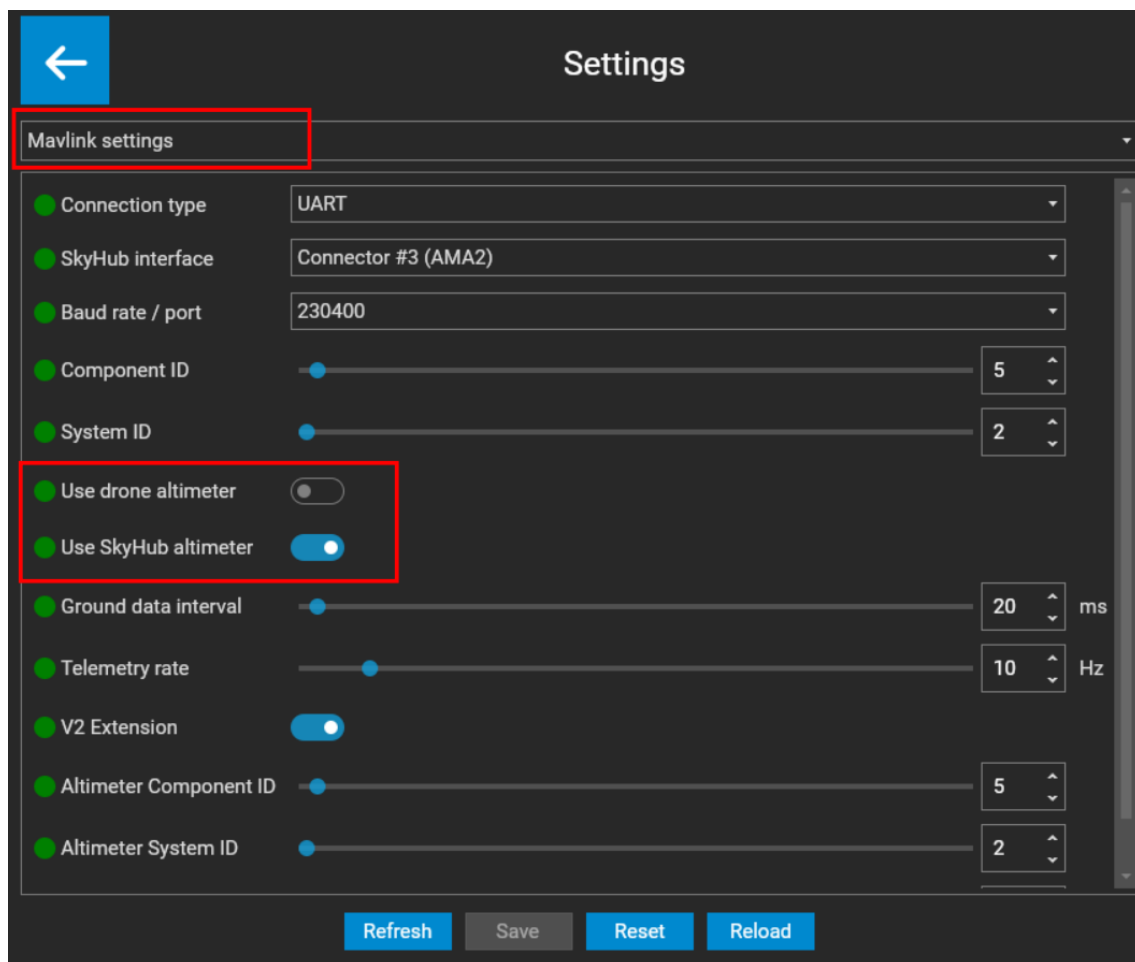


Figure 11.10. Altimeter toggles

9. Click on the drop-down list once more, and select the “Altimeters” section.
10. Set the default altimeter to your model (in our example, Einstein US-D1). Click “Save” and confirm reload.

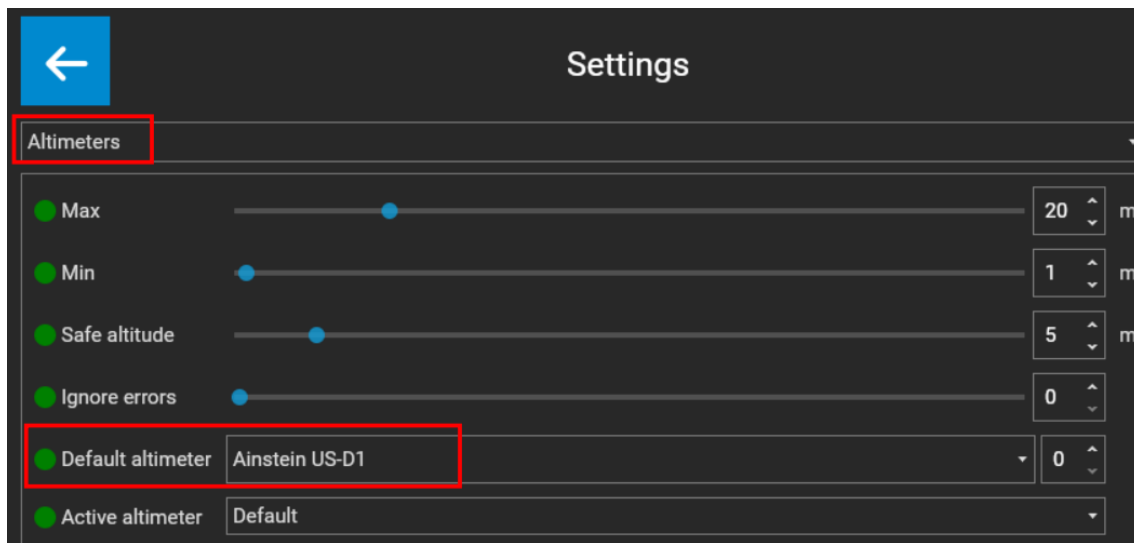


Figure 11.11. Default altimeter Ainstein

11. Go back to the main menu and click “Start” button.
12. From the drop-down list select your altimeter (in our example it is “Altimeter:Ainstein US-D1”) and press the “+” button.

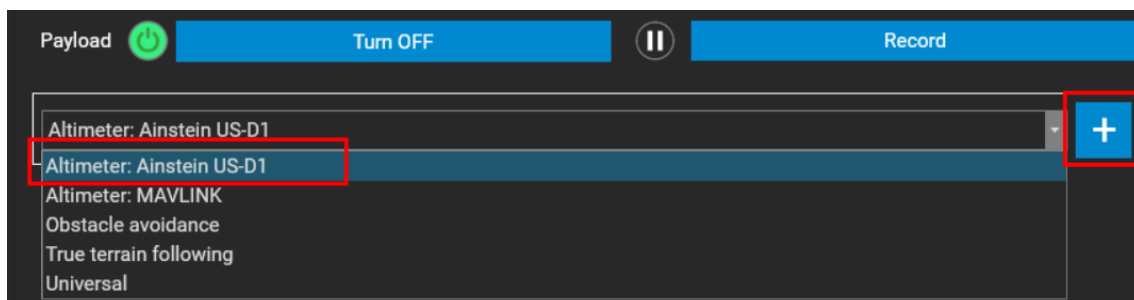


Figure 11.12. Altimeter: Ainstein US-D1 widget

13. Altimeter configuration is complete.

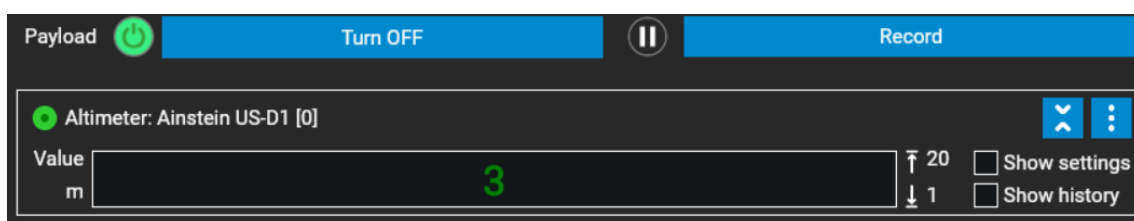


Figure 11.13. Widget is ready

### 11.4.2 When Altimeter is connected directly to the drone

1. Connect the altimeter to your drone.
2. In the UgCS-CPM software, navigate to the “All settings” section.

3. From the drop-down list select “Mavlink settings”
4. Make sure that “Use SkyHub altimeter” option is enabled.
5. Make sure that “Use drone altimeter” option is enabled.
6. Click “Save” button and confirm reload.

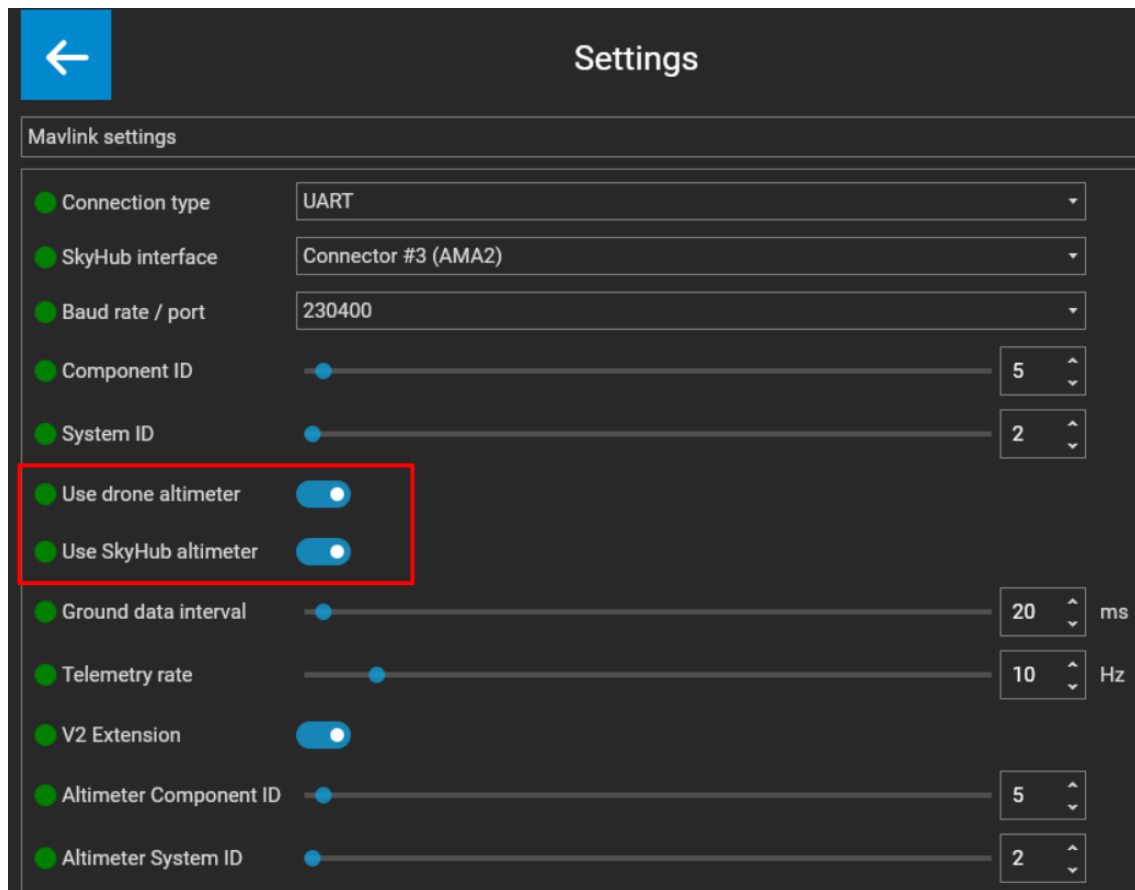


Figure 11.14. Altimeter toggles

7. Click on the drop-down list once more, and select the “Altimeters” section.
8. Set the default altimeter to “Mavlink (autopilot)”. Click “Save” and confirm reload.





Figure 11.15. Default altimeter Mavlink

- 9. Go back to the main menu and click “Start” button.
- 10. From the drop-down list select “Altimeter: MAVLINK” and press the “+” button.

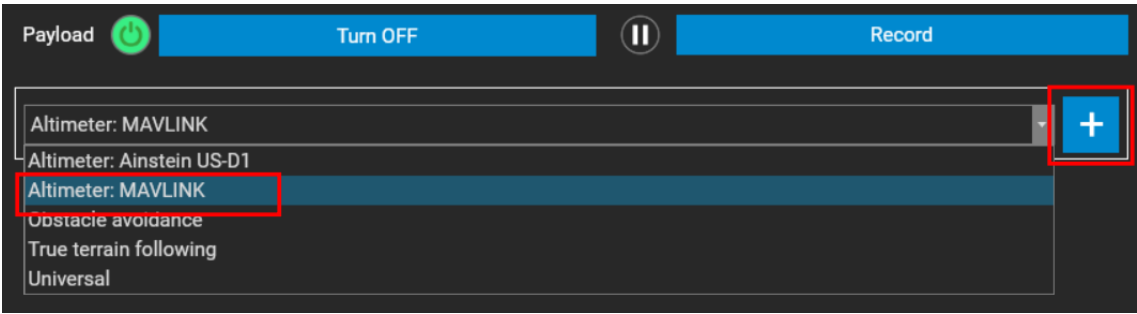


Figure 11.16. Altimeter MAVLINK

- 11. Altimeter configuration is complete.

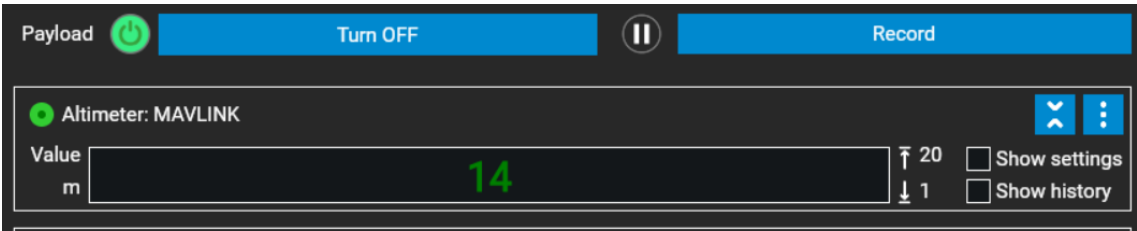


Figure 11.17. Widget is ready



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## Repeatable Survey Tutorial

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### 12.1 Introduction

#### 12.1.1 What is a repeatable survey, and why does it matter?

A repeatable survey is a data collection method in which the same flight plan is executed multiple times, on different days. Such flights can be used to monitor terrain changes over time, as well as vegetation or environmental changes.

#### 12.1.2 Key challenges in achieving repeatability

The key challenge in achieving repeatability of the flight is the inconsistency of positioning precision. Another challenge is weather conditions, especially wind. If solving the second problem requires patience, solving the first challenge requires more precise positioning using **RTK (Real Time Kinematics)**.

Now, let's take a look at how to achieve flight repeatability in more detail. To ensure that the repeatable survey results are valid, there are a few conditions that the pilot must keep in mind. The flight path must be identical across the surveys. From the georeferencing point of view, it is better to position all the ground control points and the base station in the exact same places across all the performed flights to avoid the necessity of receiving a new set of coordinates. Lastly, it is advised, though not required, to perform the surveys at the same time of day and in similar weather conditions.

### 12.2 Prerequisites

Many workflows may be used to achieve repeatability. Let's focus on two main ones: NTRIP and RTK base station.

Common prerequisites:

- The drone, remote controller, and the survey-related payloads (camera, GPR, etc.)
- RTK antenna on the drone
- In the case of PPK with the SkyHub, it will be necessary to attach an external GNSS receiver to the drone.
- Flight planning software and a flight plan.
- Understanding of coordinate systems.
- SkyHub onboard computer, if a non-DJI payload is used.

To use **NTRIP**, you will require:

- A device with an internet connection.

- Software to connect to the NTRIP service.
- NTRIP service account.

To use the physical **base station**:

- GNSS RTK positioning station.
- Preferably, the georeferenced point on the ground with the known coordinates.
- A couple of ground control points for the referencing.
- Software to set up the base station.

## 12.3 NTRIP setup

Setting up the NTRIP connection is quite simple. Let's take a look at such a setup for a DJI drone:

1. Register with the local NTRIP service provider and receive the connection details.
2. Connect the RC to the WiFi network with the internet connection.
3. Enable the RTK positioning within the DJI Pilot 2 application.
4. Select the Custom Network RTK option

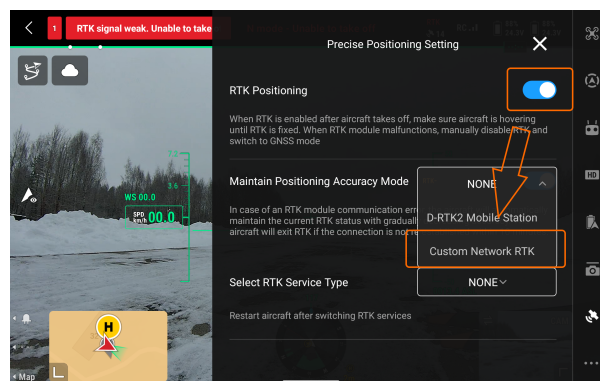


Figure 12.1. DJI Pilot 2 RTK configuration window

5. Use the connection details from the first step.

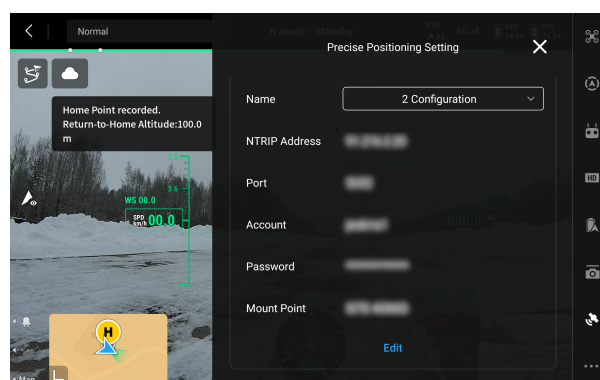


Figure 12.2. DJI Pilot 2 NTRIP setup

6. Wait until the RTK solution status becomes FIX.



Figure 12.3. DJI Pilot 2 FIX solution widget

## 12.4 RTK Base Station Setup

### 12.4.1 Base Station Positioning

The GNSS receiver needs a clear view of the sky 30 degrees above the horizon without any obstacles from buildings, vegetation, cars, or people, and without any interference from all electronics, cell towers, and other radio transmitters, or metals. When placing your receiver in the field, make sure it is placed precisely above the previously known coordinates.

When you are setting up base coordinates manually, you need to measure the antenna height offset. You can do that by measuring the distance from the mark of your known point to the bottom of your receiver. When you place the receiver over the mark and measure the antenna height, you are ready to set up the base position.

### 12.4.2 Base Station Configuration

To begin with, connect to your receiver through the native app. In this example, you can see the setup process for the Emlid Reach base station through the Emlid Flow mobile application.

1. Open the Emlid Flow app on your mobile device and establish the connection to your base station.
2. Go to the Base settings and press Configure.

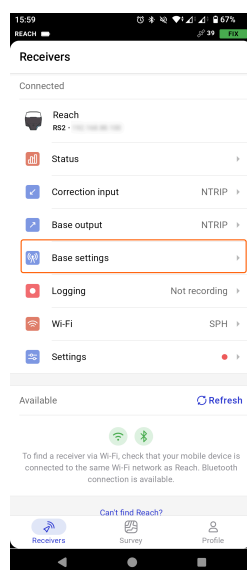


Figure 12.4. Emlid Flow Base settings

3. Click on the Coordinates entry method and select Manual from the drop-down list.
4. Next, click on the Antenna height section and fill in the value of the distance from the mark of your known point to the bottom of your receiver.
5. Enter the DD coordinates (longitude and latitude) of the known point under the receiver.

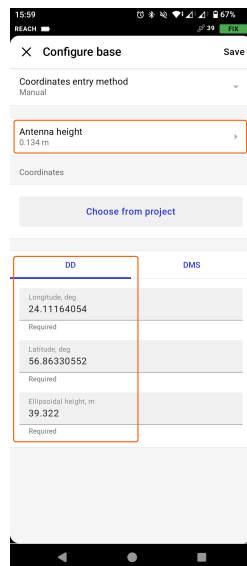


Figure 12.5. Emlid Flow Base settings

6. Setup is complete.

In terms of repeatability, make sure that the base station is located at the same spot throughout each survey that you will repeat. Place the hardware and repeat the station configuration as described above.

## 12.5 Flight Planning for Repeatability

### 12.5.1 Creating Reusable Mission Plans

The first step will be the mission planning itself. Launch the UgCS desktop software, select your drone model, select the survey type, and plan the route according to your goal.

### 12.5.2 Backing Up the Route

When ready, export the route. Use the JSON format for general backup. This will cover you in case of a laptop (hardware) malfunction. Recreating a mission by hand might get tricky and will take unnecessarily long. Go to the route properties and then the Export button.

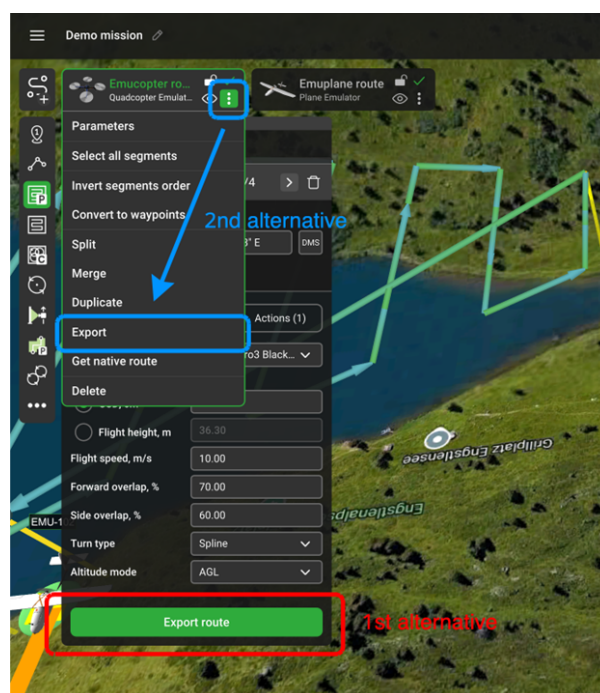


Figure 12.6. UgCS Route Export

**Note** Note that UgCS recalculates the route each time you open it or make any changes. Thus, you also need to use the same DEM, drone and payload profile each time. Depending on the drone and software you will be using to execute the flight, you can additionally export your route in KMZ (for further upload to the DJI Pilot 2 app on the remote controller) or use the Native Route for PixHawk-based drones.

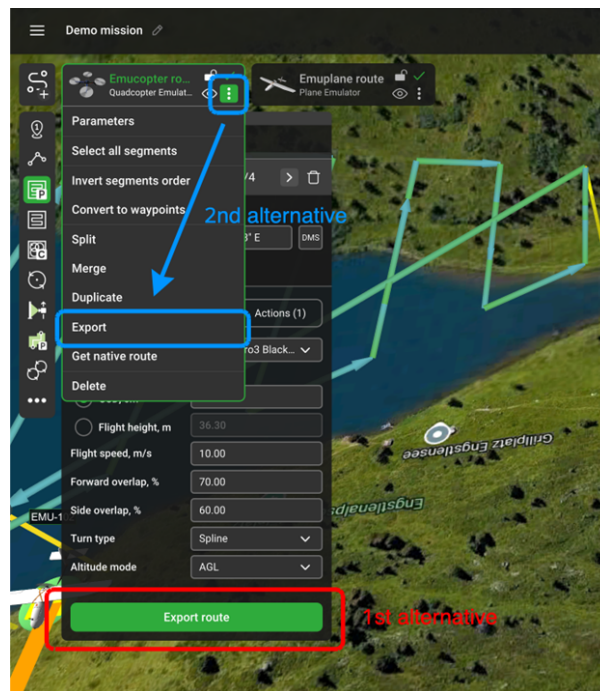


Figure 12.7. UgCS Get Native Route

## 12.6 Sensor Configuration

### 12.6.1 Sensor-specific Settings for Repeatability

If the survey includes any standalone payload (sensor) attached to the drone, make sure that the configuration of the SkyHub and the payload itself is the same throughout each flight. This will ensure that the collected flight data can be compared with each other, excluding the inaccuracies during the hardware setup. The same goes for any external GNSS receivers (if any are used) and the post-processing software. Collected data sets must be post-processed with the same pattern.

## 12.7 Survey Execution

### 12.7.1 Base Station Verification

Before each survey, check the status overview in Emlid Flow app. Click on the Correction input and check if the NTRIP is receiving corrections. Next, click on the Status and verify the satellite count and solution status (if additional NTRIP connection is used on the base station).

Lastly, if further PPK will be necessary, check if the raw satellite data is being recorded on the base station. Navigate to the Logging section, make sure that the position track and base corrections are being recorded. By the end of the survey, RINEX data will be available for download and further post-processing.



## 12.8 Repeated Survey Execution

### 12.8.1 Using Saved Mission Plans

To successfully execute a repeatable mission, you will need to repeat the same flight route each time. The best way to accomplish this is by using the route from the backup as described previously. Launch the UgCS software, navigate to the top left corner, click on the “Add new route” button, and select your JSON file. Note that other formats will not contain all the necessary information about a route. When the route is open, it is ready to be uploaded to the drone.

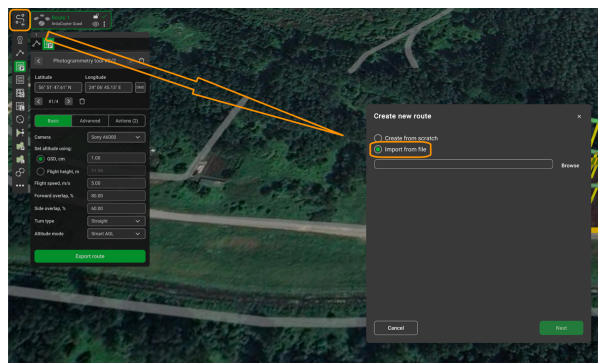


Figure 12.8. UgCS Get Native Route

### 12.8.2 Verifying Consistency Between Surveys

After a couple of flights, it is wise to check the consistency of the data collected across the surveys. This will allow you to determine mistakes (if there are any) and not waste time on further missions, since the result data will not be valid.

Make sure that the same base station is used and that the antenna height is set identically each time. Next, confirm that all surveys use the same coordinate reference system for both horizontal and vertical heights. Lastly, maintain the same flight altitude, speed, and payload settings (if any are in use).

Additionally, you may compare the RTK deviation values across all flights. Maintaining it within the same range each time will ensure better repeatability.

## 12.9 Data Management

Placing a base station at the same spot and running the same missions may not be enough to ensure repeatability. It may also be useful to document the entire workflow and create a “readme” file. This may include base station positioning, RTK deviation values, mission specifics, weather conditions, etc.

It is also a good practice to back up the entire project data, including the surveying data. The 3-2-1 backup rule will ensure reasonably secure storage: keep three copies of data, on two types of media, with one stored offsite.

## 12.10 Common Issues and Troubleshooting

### 12.10.1 RTK FIX Loss During Flight

If during the flight, you notice that the RTK status is degraded, you will have two options: either continue the flight without the corrections, or return and troubleshoot the connectivity issue. In both cases, such a flight

will not be suitable for the data comparison.

**Resolution:**

- **For NTRIP users:** Check the internet connection on the remote controller. Ensure stable cellular or Wi-Fi coverage in the survey area. Consider using a mobile hotspot with a stronger signal or relocating closer to a cell tower.
- **For base station users:** Verify the radio link between the base station and the drone. Reduce the distance between them or reposition the base station to a higher elevation for better line-of-sight. Check the base station battery level.
- **General:** Ensure the drone's RTK antenna has a clear sky view and is not obstructed by payload equipment. After resolving the issue, restart the mission from the beginning to maintain data consistency.

### 12.10.2 Position Drift Between Surveys

If, during the data comparison between the surveys, you notice that the drone position differs relative to the flight path, most probably this is the result of incorrectly set base station coordinates or incorrect placement of the base station itself.

**Resolution:**

- Verify that the base station is positioned at the exact same marked location for each survey. Use physical ground markers or survey nails for precise placement.
- Double-check the manually entered base coordinates and antenna height values match previous surveys.
- If using NTRIP, ensure you are connecting to the same mount point each time, as different mount points may use different reference frames.

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## D-RTK Base Station Guide

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### 13.1 Introduction

#### 13.1.1 What Is an RTK Station

**Real-Time Kinematic (RTK)** positioning is a satellite navigation technique used to enhance the accuracy of GNSS measurements. An RTK station operates as a reference point with a known or precisely calculated position. By comparing its known position to the position calculated from satellite signals, the station generates correction data that is transmitted in real time to a drone.

Unlike standard GNSS, which typically provides meter-level accuracy due to atmospheric errors, satellite clock drift, and signal noise, RTK uses real-time corrections to compensate for these errors. This allows RTK-enabled systems to achieve centimeter-level horizontal and vertical accuracy.

Within the DJI ecosystem, the D-RTK 3 serves as a high-precision GNSS reference station that supplies correction data directly to compatible DJI aircraft and controllers.

#### 13.1.2 Use Cases

The DJI D-RTK 3 is designed for professional applications where high positional accuracy is essential, including aerial mapping and photogrammetry, surveying, and other high precision applications. By providing reliable RTK corrections, the D-RTK 3 enhances data accuracy, reduces the need for ground control points, and improves overall operational efficiency.

### 13.2 Prerequisites

- Compatible DJI drone equipped with an integrated RTK module or RTK antenna

The full capabilities of the D-RTK3 station can be used with a DJI 4th generation drone (DJI M400, M4E/4T, M4D/4TD). The station can be set up with manual calibration, with the help of a custom network (NTRIP) and using Precise Point Positioning (PPP). Using older drones and controllers the station does not support PPP and only supports base station mode.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Base Station Mode:</b></p> <p><b>Enterprise:</b></p> <p>Matrice 400<br/>Matrice 4E, Matrice 4T<br/>Matrice 4D, Matrice 4TD (DJI RC Plus 2 Enterprise)<br/>Matrice 3D/3TD (DJI RC Pro Enterprise)*<br/>Matrice 300/350 RTK*<br/>Matrice 30 Series*<br/>Mavic 3 Enterprise Series*<br/>DJI FlyCart 100</p> <p><b>Agriculture:</b></p> <p>T60*<br/>T50/T25*<br/>T40/T20P*<br/>DJI FlyCart 30*</p> <p><b>Professional Filmmaking:</b></p> <p>DJI Inspire 3*</p> <p><small>* Currently, only manual D-RTK 3 position calibration is supported. Please refer to official updates for future feature enhancements.</small></p> | <p><b>Relay Station Mode <sup>[2]</sup>:</b></p> <p>DJI Matrice 400<br/>Matrice 4E, Matrice 4T<br/>Matrice 4D, Matrice 4TD (DJI RC Plus 2 Enterprise)<br/>DJI FlyCart 100</p> <p><b>Rover Station Mode:</b></p> <p>Supports Bluetooth 5.1, compatible with Android 10 and above*</p> <p><small>* See the tested compatibility phone list on the download page for details.</small></p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Figure 13.1. Currently supported models with D-RTK3 station ((check for current information: <https://enterprise.dji.com/d-rtk-3>))

- Required accessories (tripod, mounting pole)
- DJI Pilot 2 for connecting the RTK to the drone and configuring settings
- DJI Enterprise 2 for firmware updates, coordinate system configuration, and Rover Station mode
- UgCS Companion for flying SkyHub missions

## 13.3 First Activation

### 13.3.1 Charging and turn on procedure

Charge the device before powering on for the first time. Make sure to use a PD3.0 USB charger with 9 to 15 V voltage, such as a DJI 65W portable charger. Once it is charged the battery symbol will turn green. Then press, and press and hold the power button to turn on the device.

### 13.3.2 Activation and initial firmware update

The product needs to be activated before first use.

When used as a base or relay station, it can be activated by following prompts in DJI Pilot 2 when connecting to the drone and the controller if it has internet connection.

When used as a rover station, you need to download DJI Assistant 2 (Enterprise Series) and connect the D-RTK3 station to a computer using a USB-C cable. Activate the device in DJI Assistant 2.

## 13.4 Indicators and Status Information

### 13.4.1 Battery Indicators

|  | Battery Level |
|-----------------------------------------------------------------------------------|---------------|
|  | > 60%         |
|  | 20%-60%       |
|  | < 20%         |

### 13.4.2 Operating Modes

|  | Operating Modes |
|-----------------------------------------------------------------------------------|-----------------|
|  | Base Station    |
|  | Rover Station   |
|  | Relay Station   |

#### Base Station Mode

In Base Station Mode, the D-RTK 3 operates as a fixed reference station that continuously calculates RTK correction data based on its known or averaged position. These corrections are transmitted in real time to compatible DJI aircraft to improve positioning accuracy during flight. This results in consistent absolute accuracy across multiple flights and reduced reliance on ground control points.

#### Relay Station Mode

Relay Station Mode is used to extend communication and RTK correction coverage between the base station and the aircraft. It is particularly useful in large operational areas or environments where terrain, vegetation, or structures may obstruct direct signal transmission. For optimal performance, the relay station should be positioned at an elevated location with clear visibility to both the base station and the aircraft.

#### Rover Station Mode

In Rover Station Mode, the D-RTK 3 functions as a mobile GNSS receiver for collecting high-precision ground measurements. This mode is typically used for surveying tasks such as recording ground control points or check points.

### 13.4.3 GNSS Signal Indicators

|  | Satellites Received |
|-------------------------------------------------------------------------------------|---------------------|
|  | > 30                |
|  | 10-30               |
|  | < 10                |

## 13.5 Base Station Setup

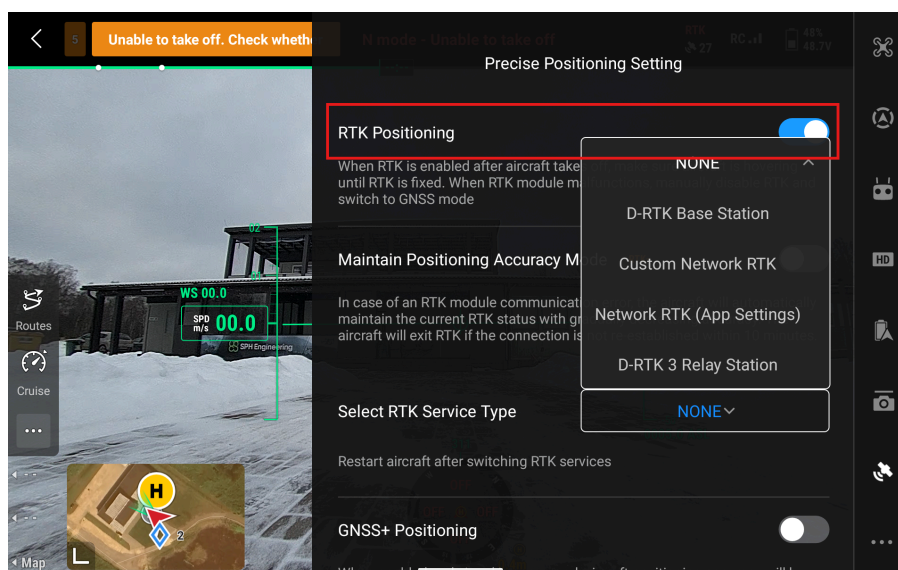
The station requires a wide field of view. Make sure to place the device so that there are no obstructions within a 15 degree angle above the horizontal plane of the antennas to prevent GNSS signals to be blocked. The location should be at least 200m from high-power radio emission sources (television stations, microwave stations, etc.) and at least 50m away from high voltage transmission lines to avoid electromagnetic interference. The location also should be away from large bodies of water or objects that strongly interfere with satellite signal reception.

Use the survey pole and tripod kit (if you have one) to set up the station. Make sure it is level according to the built in leveller.

You can consult the DJI manual for further information: [https://dl.djicdn.com/download-s/d-rtk-3/UM/20250116/D-RTK-3\\_User%20Manual\\_v1.0\\_en.pdf](https://dl.djicdn.com/download-s/d-rtk-3/UM/20250116/D-RTK-3_User%20Manual_v1.0_en.pdf)

## 13.6 Connecting to DJI M400 or another 4th generation DJI drone

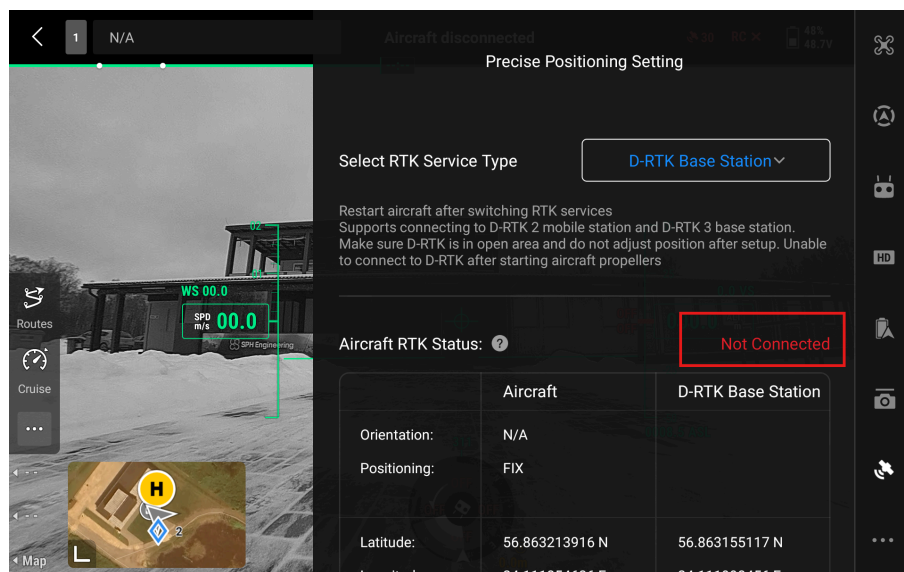
1. Set up the D-RTK3 station and turn it on by pressing, and then pressing and holding the power button.
2. Turn on the drone and the remote controller.
3. Start DJI Pilot 2 and head over to Settings and select Precise Positioning Setting
4. Enable RTK Positioning



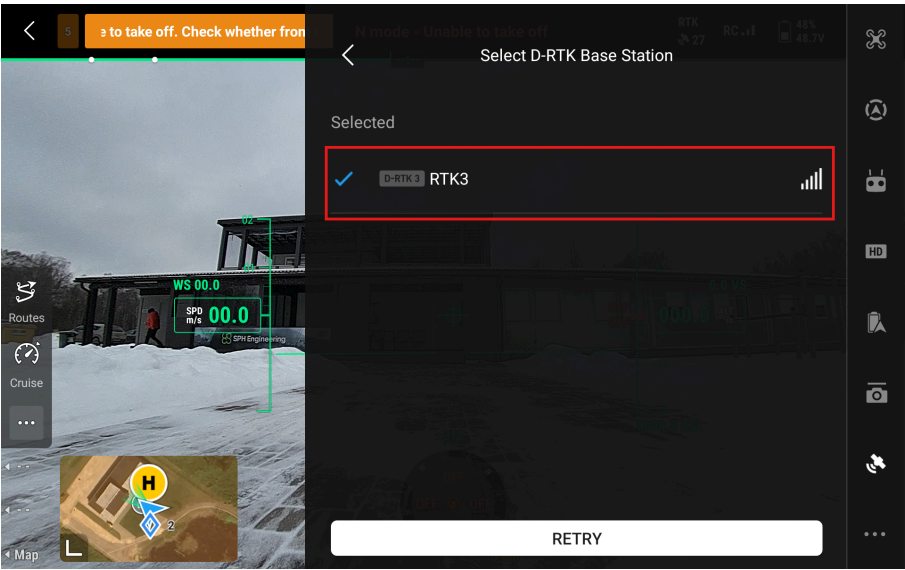
5. Select RTK Service Type and select D-RTK Base Station



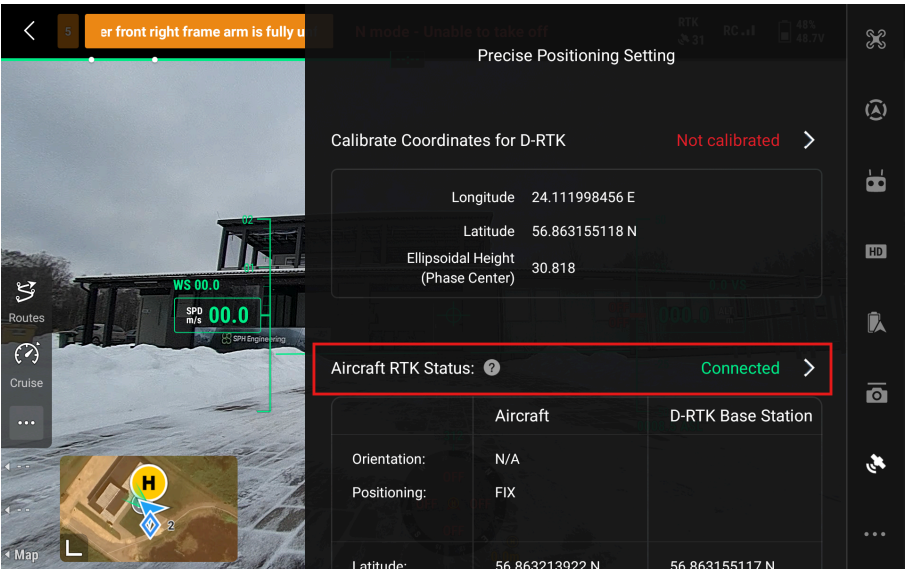
## 7. Select D-RTK Base Station - RTK3





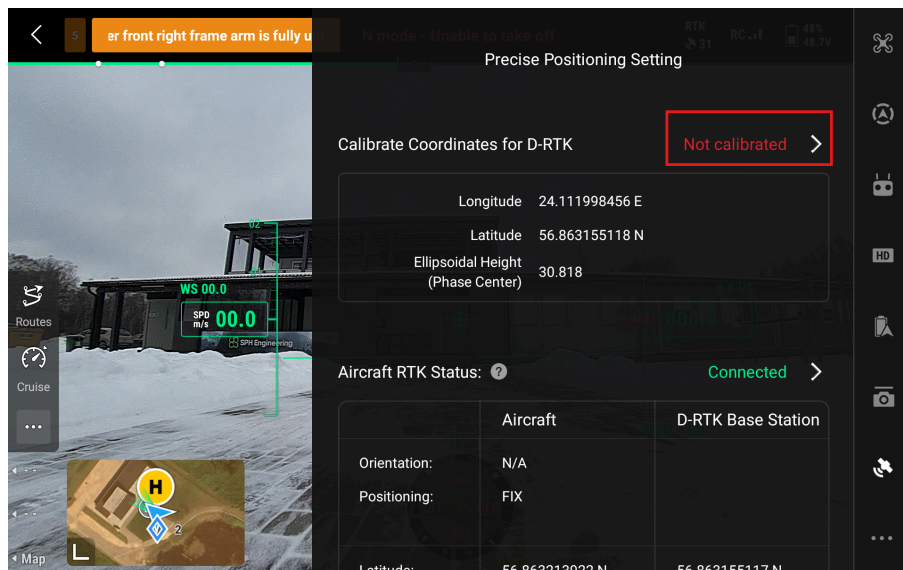


8. **Aircraft RTK Status** should start to show **Converging** and eventually turn to **Connected** (green). If the status stays on **Converging** for too long even when the drone has access to GNSS satellites (is outside in a clear area) then restart the drone and remote controller.

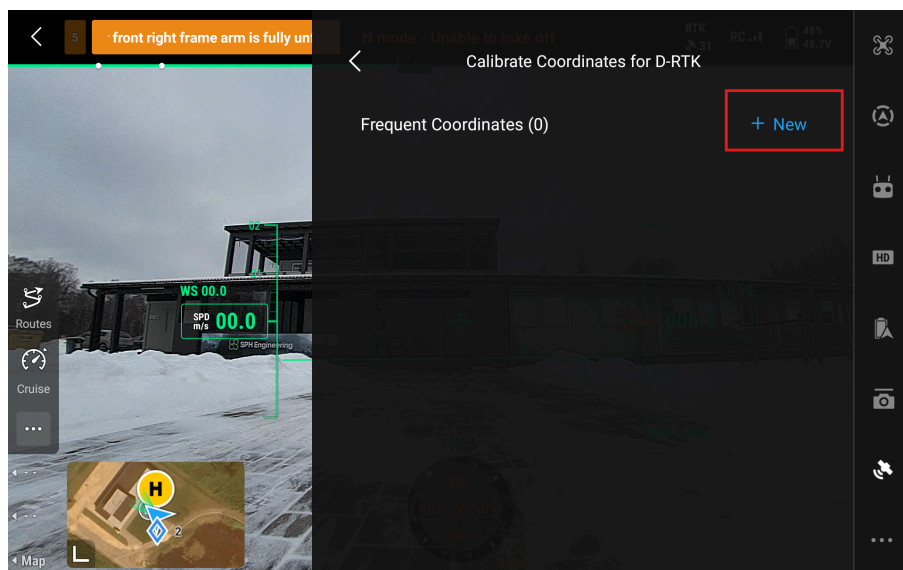


9. Now we need to calibrate the coordinates. Head to **Calibrate Coordinates for D-RTK** and press **Not Calibrated**.





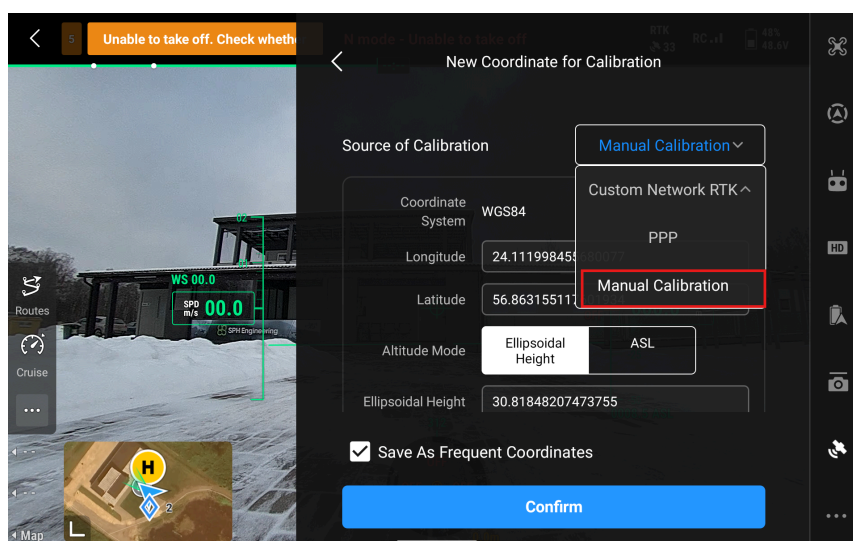
#### 10. Select New



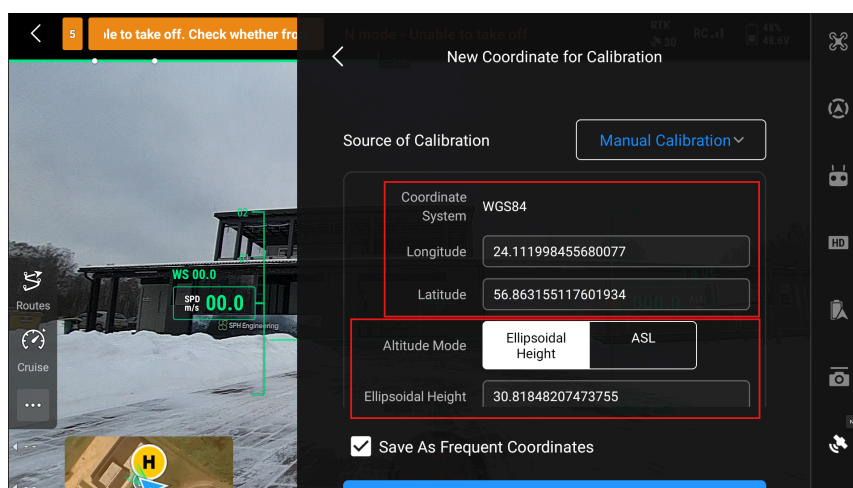
11. Now you have to choose the Source of Calibration. There are three ways to calibrate the station - Manual Calibration (if you know specific coordinates of the station), Custom Network RTK or NTRIP (if you have access to a service) and Precise Point Positioning or PPP (longer calibration time but quite precise).

##### 11.1. Manual Calibration

Use this only if you know precise coordinates of the D-RTK3 station. Then input these coordinates in the Longitude and Latitude sections. You can save them as Frequent Coordinates if you plan on using the same station location in further flights.



When you select Manual Calibration, then it will automatically generate some coordinates for the station but these are very imprecise. Our tests generally show a difference of 2-4 meters compared to the actual location. Here you can enter the Longitude and Latitude of the base station as well as its height.



### 11.2. Custom Network RTK

The Custom Network RTK option should be used as the calibration source for the D-RTK 3 when a reliable third-party or regional RTK network is available. In this configuration, the D-RTK 3 receives correction data from an external RTK network via an internet connection and uses it to determine and maintain its reference position. Using a network RTK source allows for faster deployment of the station eliminating time spent on coordinate averaging. This method requires constant network connection.

In DJI Pilot 2, select Custom Network RTK as Source of Calibration and input the NTRIP Address, Port, Account, Password and Mount Point to use this method as a source of calibration.

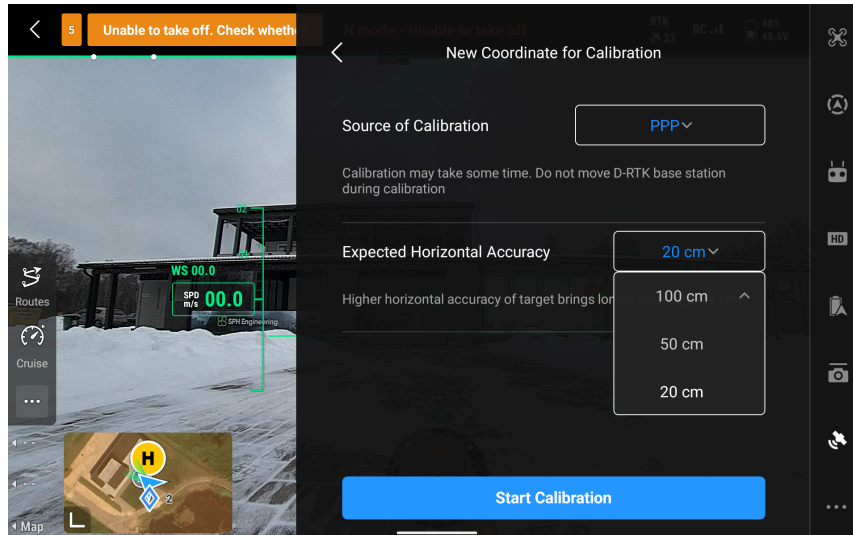
### 11.3. Precise Point Positioning (PPP)

Precise Point Positioning (PPP) should be used as the calibration source for the D-RTK3 station when RTK correction services are unavailable or impractical, and a high level of absolute positioning accuracy is still required. PPP is particularly useful in remote or isolated locations where there is no access to cellular networks or permanent RTK infrastructure; it allows the D-RTK 3 to operate independently. PPP can also serve as a fallback calibration method when network RTK connections are unstable or unreliable.

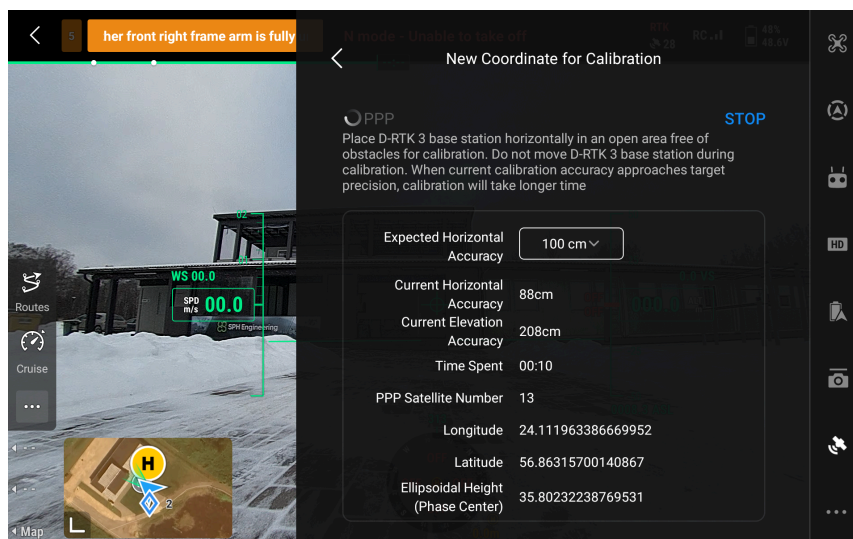
While PPP does not typically achieve the same real-time centimeter-level accuracy as RTK, it provides stable decimeter-level positioning once convergence is reached. In DJI Pilot 2 it is possible to choose three accuracy levels - 100cm, 50cm, and 20cm Expected Horizontal Accuracy. In our tests, 100cm accuracy

was done calibrating in around 5 minutes, 50 cm was done in around 10 minutes, and the 20cm - in 20 minutes. Depending on the situation, connection and access to GNSS, this process may take significantly longer.

To set up PPP in DJI Pilot 2, select PPP as the Source of Calibration. Then you need to select your expected horizontal accuracy and click on Start Calibration.



Then a calibration screen like this will pop up. It will take some time as mentioned before.



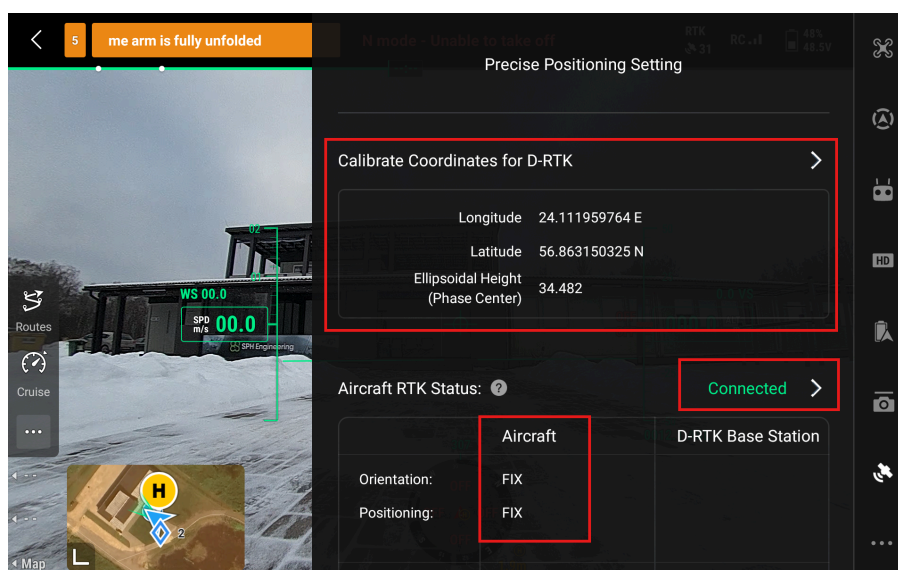
The process will automatically finish after some time and the calibrated coordinates will show up, which then you are able to save if necessary.

12. After calibrating the coordinates for D-RTK in any of the aforementioned ways, the Precise Positioning Setting should look like this.

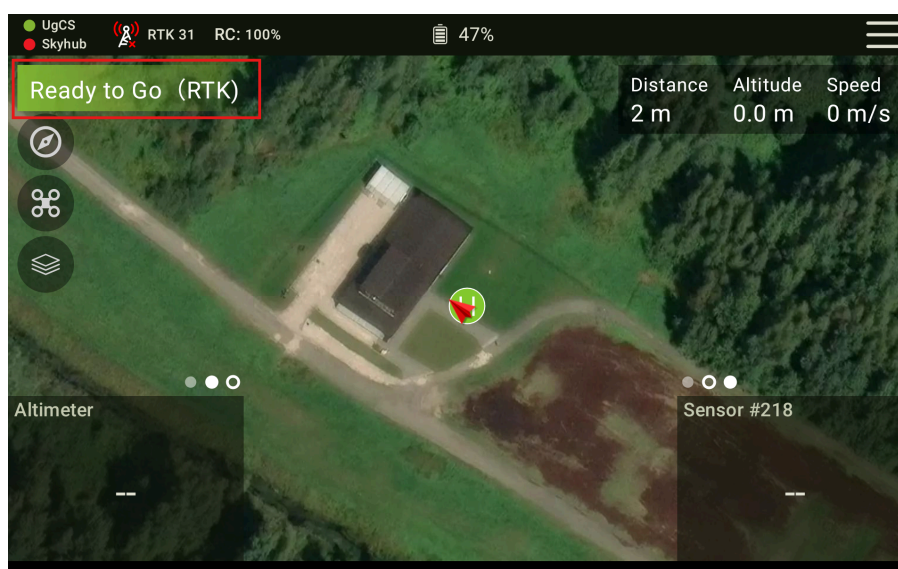
- Precise coordinates shown and no Not Calibrated option
- Aircraft RTK Status - Connected
- Aircraft FIX Positioning

If this is the case then the RTK is configured successfully.





13. Now further information for if you are flying your mission with **UgCS Companion**. Firstly, close the DJI Pilot 2 application fully, so it is not running in the background. Then open up UgCS Companion and connect it to the drone as you normally would. If the drone is operational and ready to fly with RTK, it should show Ready to Go (**RTK**). And when pressing the RTK symbol at the top left of the screen, it shows RTK Status - Connected.



**Note** If you are using an older version of UgCS Companion and when you click on the RTK symbol it shows RTK symbol - Unknown, then it is okay to continue **only if the main screen in Companion shows Ready to Go RTK**.

## 13.7 Connecting to DJI M300/M350 drones

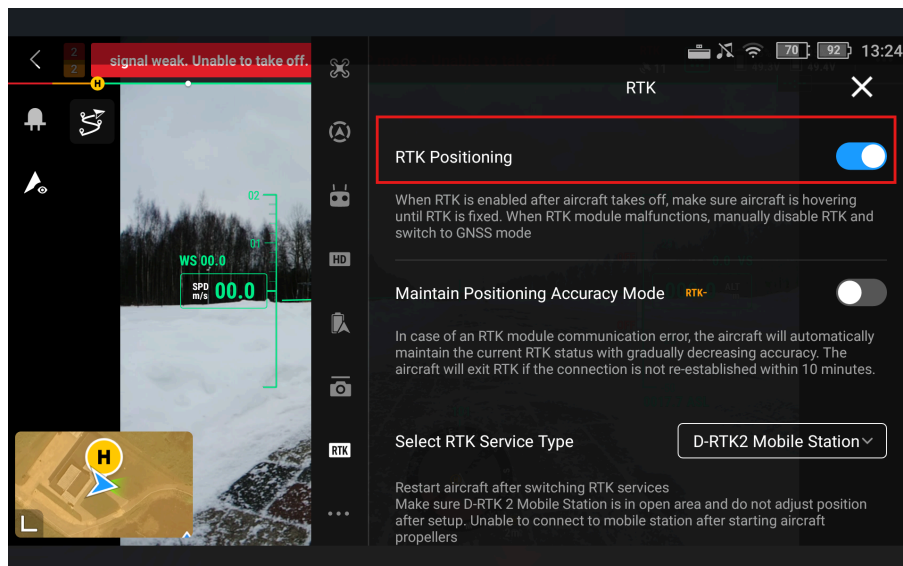
Using older DJI drones will require **manual base station calibration**. It is necessary to enter accurate coordi-

coordinates for the D-RTK 3 station. These coordinates must represent the true geodetic position of the antenna reference point. There are two common approaches to obtain this information:

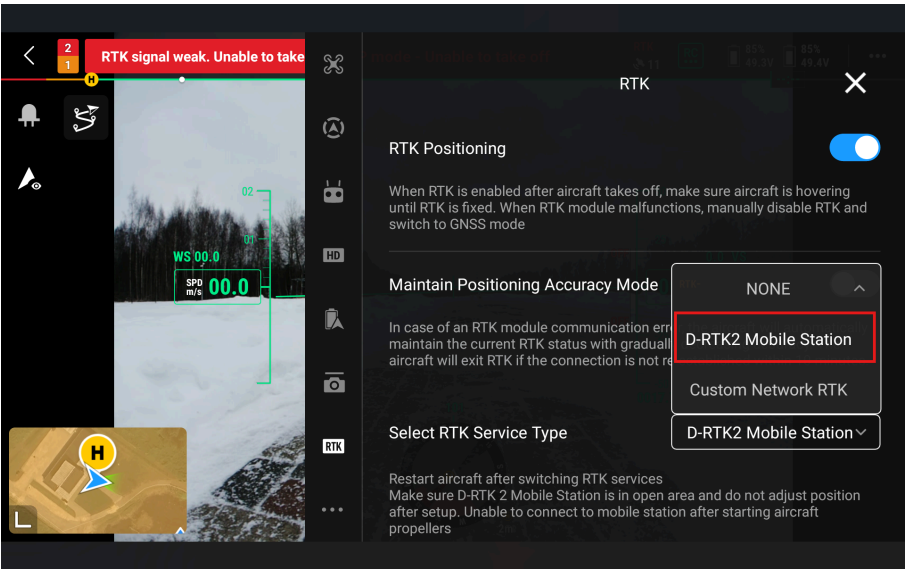
- **Using an Existing Geodetic Control Point.** If a known geodetic (survey) control point is available near the planned base station location, its official coordinates can be obtained from the national or regional geodetic network authority. The D-RTK 3 antenna can then be positioned directly over this point, and the published coordinates can be entered into the system.
- **Measuring with Another RTK-Capable GNSS Receiver.** A separate RTK-enabled GNSS receiver can be used to measure the base station position by connecting to a correction service via NTRIP. After achieving a fixed RTK solution, the measured coordinates can be recorded and used as the reference coordinates for the D-RTK 3 station.

If you do not have the resources to precisely measure the coordinates for the base station then this method is not recommended. Otherwise, it will automatically generate some coordinates for the station but these are very imprecise. Our tests generally show a difference of 2-4 meters compared to the actual location of the station.

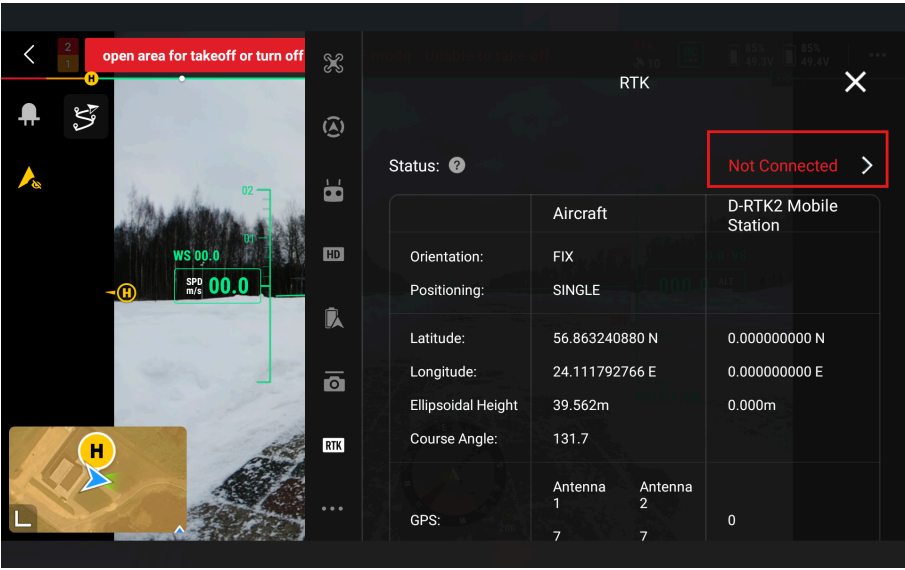
1. Set up the D-RTK3 station and turn it on by pressing, and then pressing and holding the power button.
2. Turn on the drone and the remote controller.
3. Start DJI Pilot 2 and head over to Settings and select RTK
4. Enable RTK Positioning



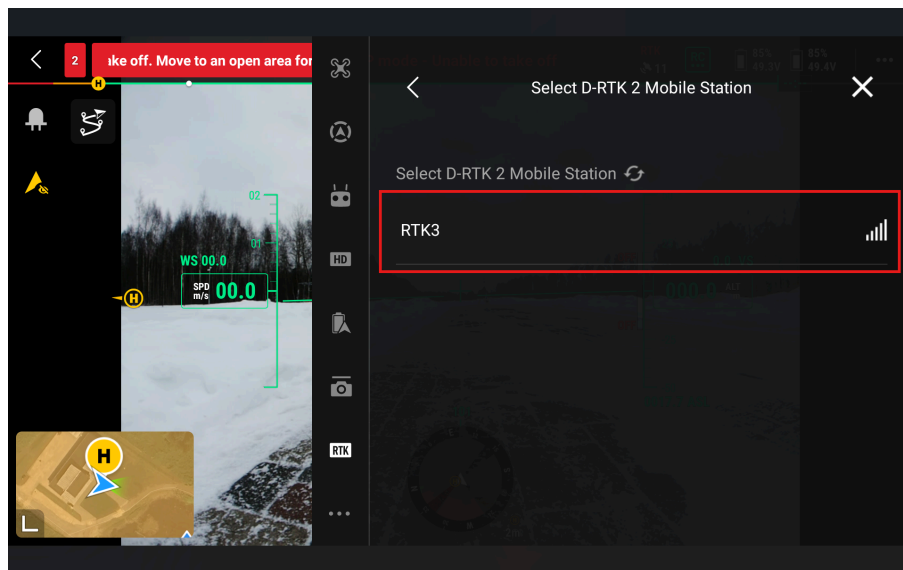
5. Go to RTK Service Type and select D-RTK2 Base Station



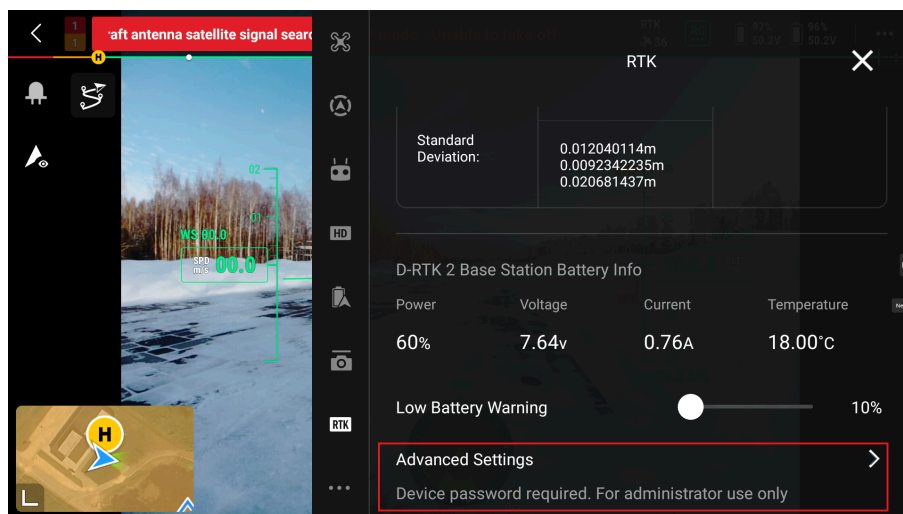
6. Go to Status and click Not Connected



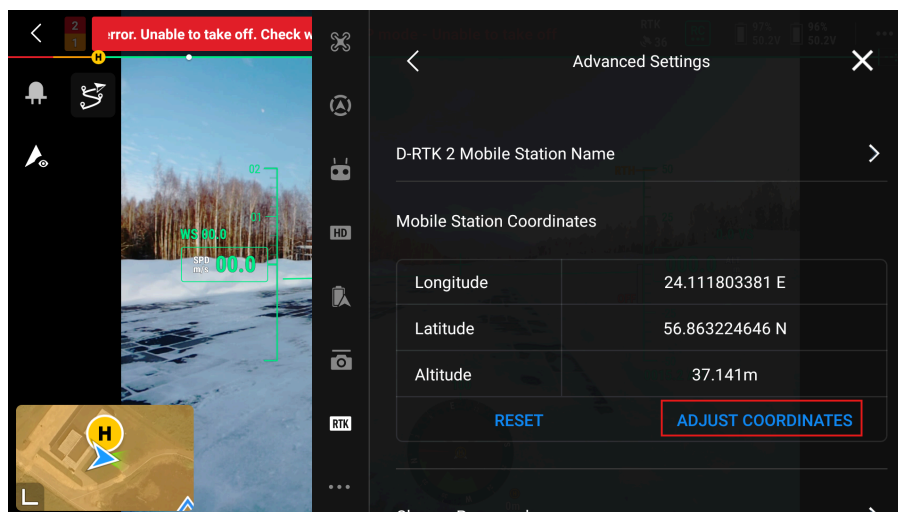
7. Select RTK3



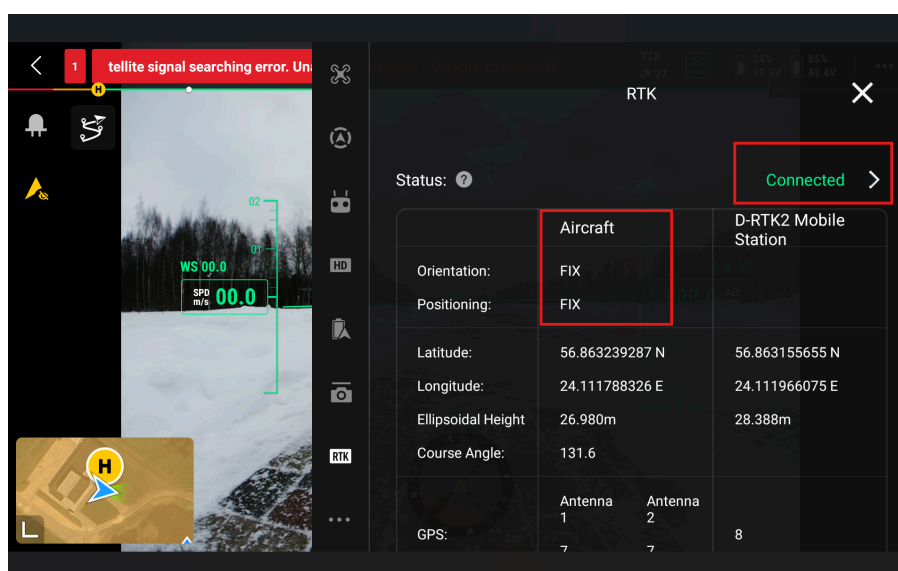
8. To put in the coordinates of your base station, go to the bottom of the screen and press Advanced settings. There you will be able to change the automatic coordinates of the D-RTK3 base station.



9. Then input the Longitude, Latitude and Altitude of the station.

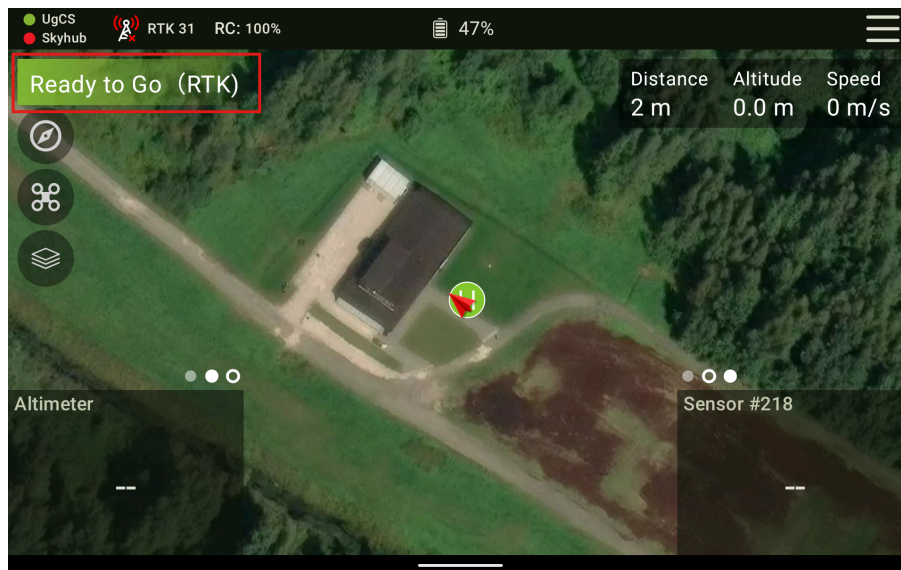


10. After setting up the base station the Aircraft RTK status should show FIX Positioning.



11. Now further information for if you are flying your mission with **UgCS Companion**. Firstly, close the DJI Pilot 2 application fully, so it is not running in the background. Then open up UgCS Companion and connect it to the drone as you normally would. If the drone is operational and ready to fly with RTK, it should show Ready to Go (**RTK**). And when pressing the RTK symbol at the top left of the screen, it shows RTK Status - Connected.





**Note** If you are using an older version of UgCS Companion and when you click on the RTK symbol it shows RTK symbol - Unknown, then it is okay to continue **only if the main screen in Companion shows Ready to Go RTK**.

## 13.8 Operational Workflows

**Before flight**, the operator should confirm that the D-RTK 3, aircraft, and controller firmware are up to date and that all devices are fully charged. The D-RTK 3 should be correctly configured in the required operating mode and positioned in an open area with clear sky visibility. Coordinate source and calibration method should be verified, and the connection between the D-RTK 3, controller, and aircraft should be established. Prior to take-off, the RTK status displayed in DJI Pilot 2 should indicate an RTK Fix or Ready to Go (RTK) in UgCS Companion, and satellite signal strength should be sufficient.

**During flight**, the operator should continuously monitor RTK status and GNSS signal quality in the flight interface. Any transition from RTK Fix to Float or Non-RTK should be noted, as this may affect data accuracy. Stable communication links between the aircraft and the D-RTK 3 should be maintained.

**After flight**, recorded data should be reviewed to confirm that RTK positioning was maintained for the majority of the mission. Metadata, logs, or mission reports should be checked for RTK status information.

## 13.9 Troubleshooting

| Problem                                           | Fix                                                                                                                                                                                                                                                               |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RTK Fix cannot be achieved or is unstable         | Verify that the D-RTK 3 is placed in an open area with a clear view of the sky, away from obstacles. Firmware mismatches between the D-RTK 3, aircraft, and controller can prevent RTK fixes. Should be updated to compatible versions.                           |
| Satellite count is low or signal strength is poor | Waiting several minutes for satellite acquisition or repositioning the station may resolve the issue.                                                                                                                                                             |
| Aircraft RTK Status - Converging for too long     | If the aircraft is inside, then that is expected, it will connect when it is outside with access to GNSS satellites. If the aircraft is outside and in a clear, non-obstructed area with access to GNSS satellites, then restart the drone and remote controller. |

|                                        |                                                                                                                                    |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| UgCS companion shows Ready to Go (GPS) | Wait for it to connect and receive more information from satellites. If waiting does not help, then try configuring the RTK again. |
|----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|

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## Setup Interface to DJI Autopilot M300 / M350

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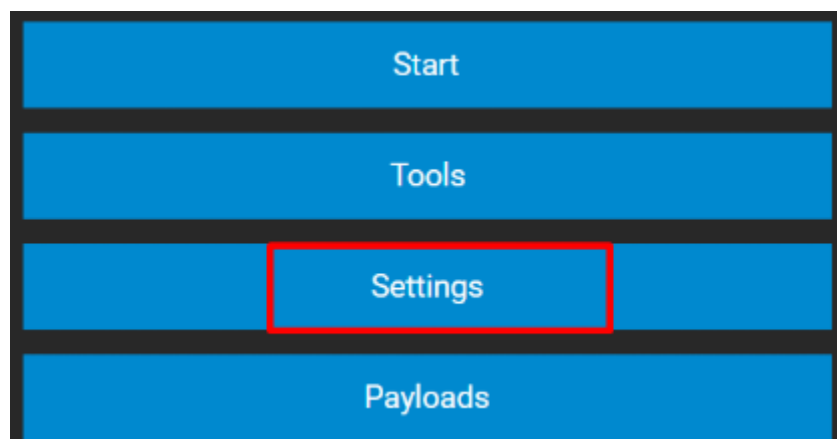
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**Note** Before the autopilot configuration, [Auxiliary or drone link connection](#) must be established between the remote controller and UgCS-CPM software on your computer.

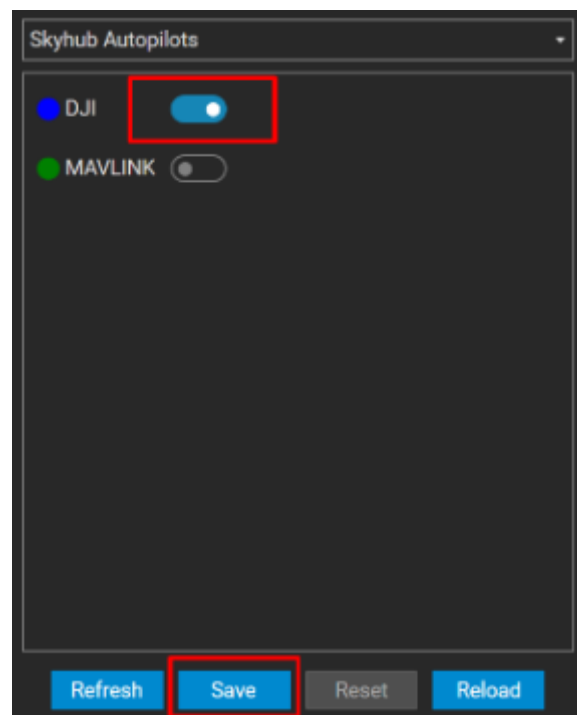
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### 14.1 Enabling the autopilot

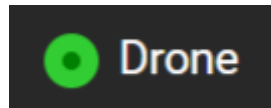
1. Press the Settings button.



2. From the drop-down list, select the SkyHub Autopilots section.
3. Enable DJI (note that only one autopilot can be enabled at a time; MAVLINK should stay disabled). Press Save and perform a system restart



Autopilot configuration is complete. After the system restart, you will notice that the drone link icon should become green.



## 14.2 DJI Obstacle Sensors Disabling

Depending on the payload used, downward obstacle sensors may need to be disabled on DJI M300 / M350. Use DJI Pilot to disable them according to the screenshots below.

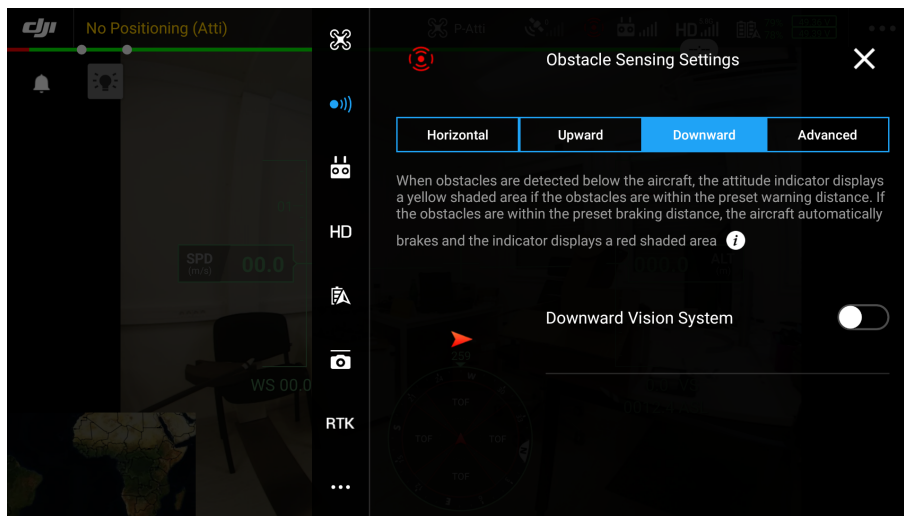


Figure 14.1. M300 / M350 RTK DJI Pilot screens

### 14.3 UgCS Companion on DJI remote controller

**Note** To establish the drone link connection between the UgCS-CPM on your computer and SkyHub on the drone, both Companion (on your remote controller) and UgCS software (on your computer) must be open.

Companion application is available for download here: [SkyHub download page](#).

UgCS Companion application establishes connection with SkyHub automatically if the DJI driver is enabled. The SkyHub indicator in the upper left corner of the application turns green if the connection is established.

If there is more than one computer with UgCS used in the network, tap on the UgCS indicator in the upper left corner of the UgCS Companion application to access the list of available UgCS instances and select the necessary one.

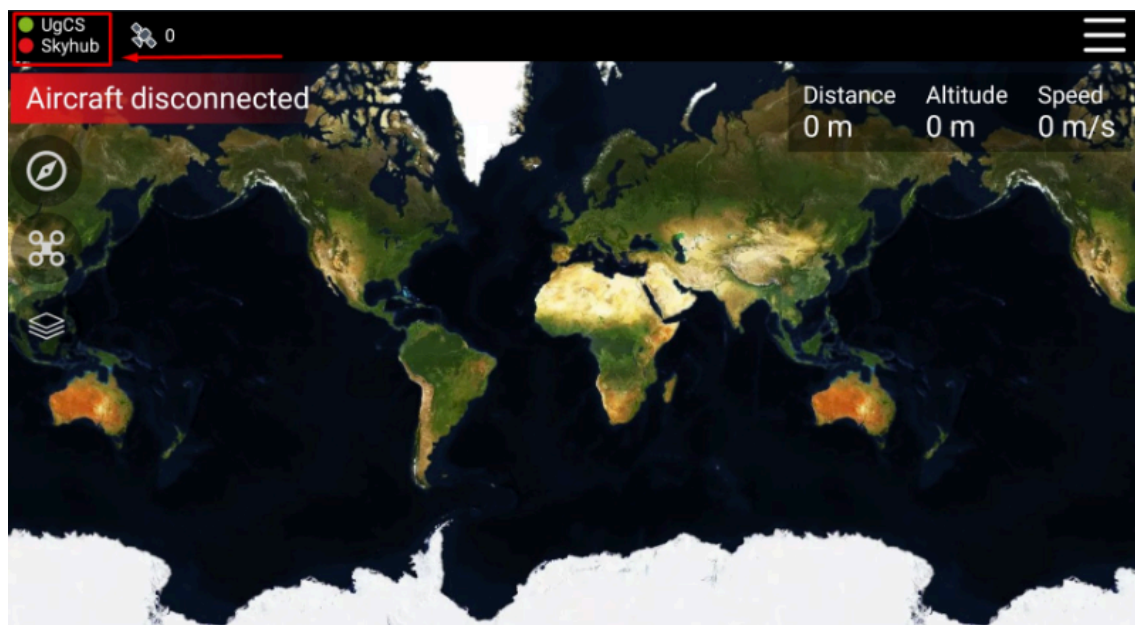


Figure 14.2. UgCS Companion server selection button

**Attention:** If the UgCS Companion application was started before SkyHub is fully powered on, the application will not detect SkyHub. An application restart will be necessary to establish the connection.

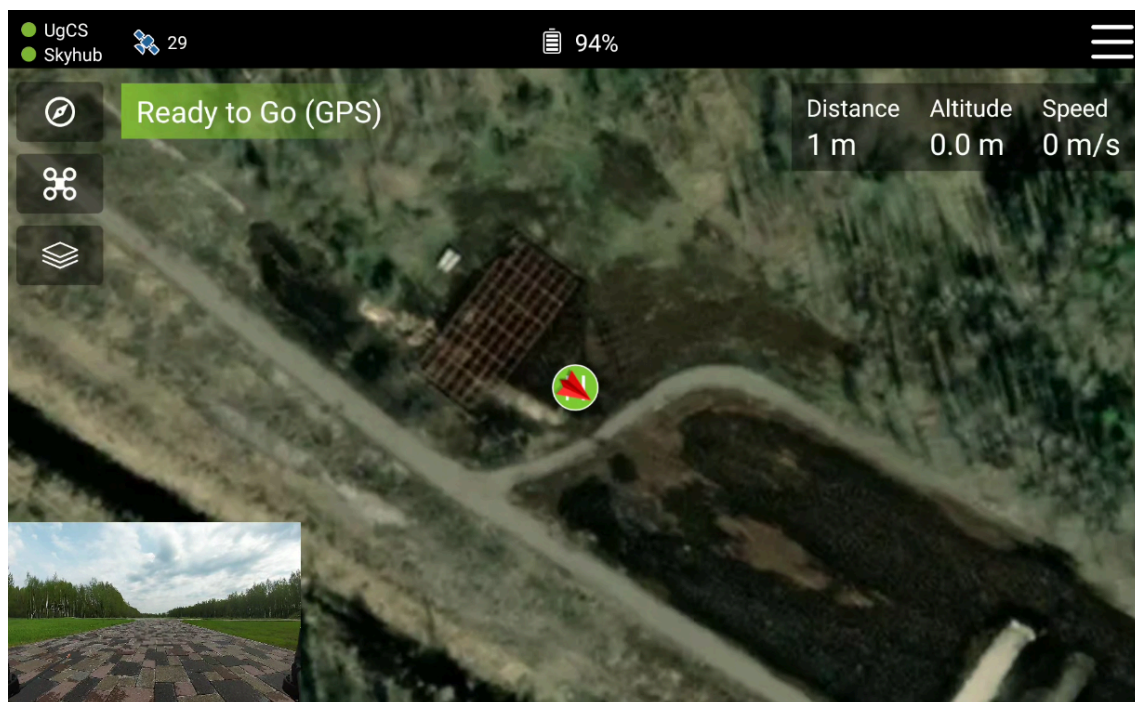


Figure 14.3. UgCS Companion SkyHub and UgCS status

---

## Setup Interface to ArduPilot

---

SkyHub can be connected to the flight controller flashed with the ArduPilot 4.x.x firmware.

1. Make sure UgCS version 4.3 or higher is used (download links can be found in [Preparation](#) section) and VSM for ArduPilot vehicles is installed.

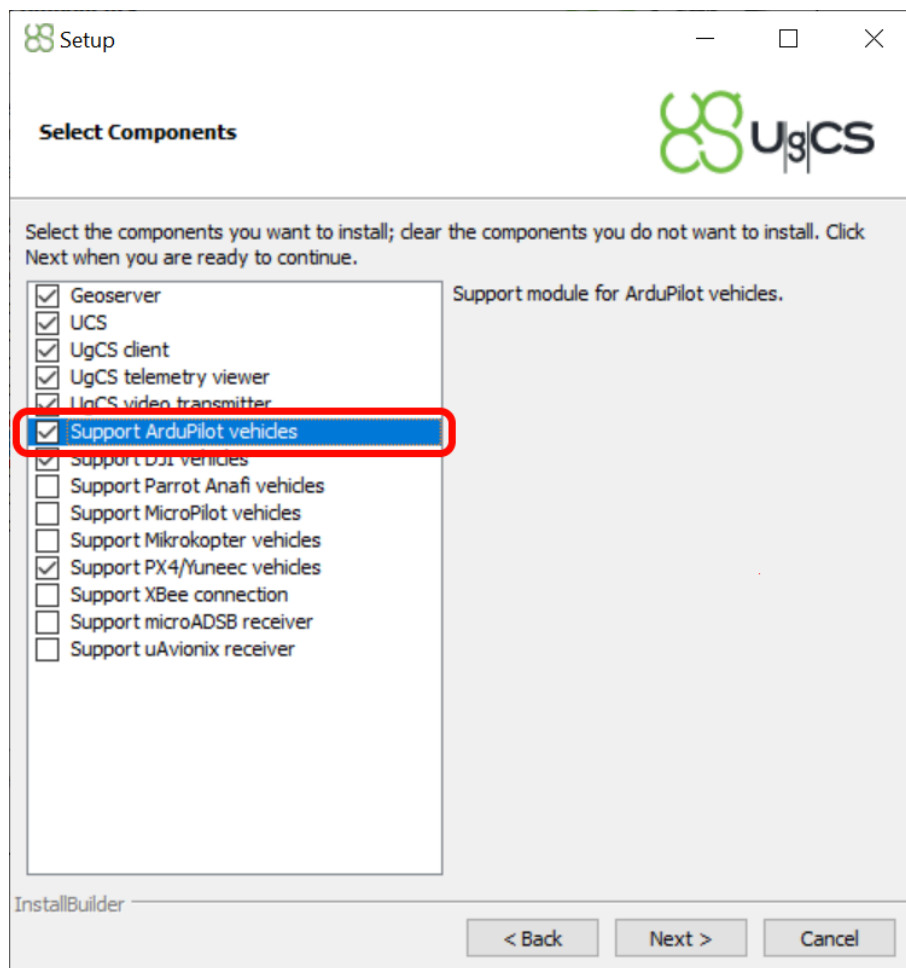
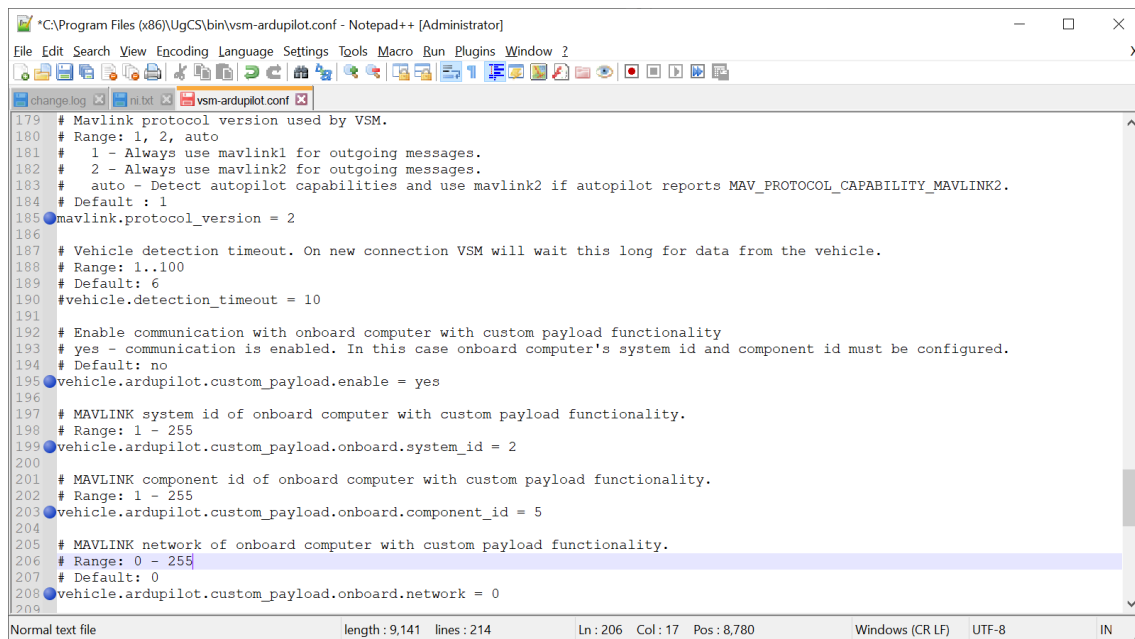


Figure 15.1. UgCS installation Support for ArduPilot vehicles

2. Configure UgCS ArduPilot VSM. Open `vsm-ardupilot.conf` in a text editor with administrator privileges. The file is located in the UgCS installation folder (default path `C:\Program Files (x86)\UgCS\bin`). Find, uncomment, and adjust the following settings if needed.



```

179 # Mavlink protocol version used by VSM.
180 # Range: 1, 2, auto
181 # 1 - Always use mavlink1 for outgoing messages.
182 # 2 - Always use mavlink2 for outgoing messages.
183 # auto - Detect autopilot capabilities and use mavlink2 if autopilot reports MAV_PROTOCOL_CAPABILITY_MAVLINK2.
184 # Default : 1
185 mavlink.protocol_version = 2
186
187 # Vehicle detection timeout. On new connection VSM will wait this long for data from the vehicle.
188 # Range: 1..100
189 # Default: 6
190 #vehicle.detection_timeout = 10
191
192 # Enable communication with onboard computer with custom payload functionality
193 # yes - communication is enabled. In this case onboard computer's system id and component id must be configured.
194 # Default: no
195 vehicle.ardupilot.custom_payload.enable = yes
196
197 # MAVLINK system id of onboard computer with custom payload functionality.
198 # Range: 1 - 255
199 vehicle.ardupilot.custom_payload.onboard.system_id = 2
200
201 # MAVLINK component id of onboard computer with custom payload functionality.
202 # Range: 1 - 255
203 vehicle.ardupilot.custom_payload.onboard.component_id = 5
204
205 # MAVLINK network of onboard computer with custom payload functionality.
206 # Range: 0 - 255
207 # Default: 0
208 vehicle.ardupilot.custom_payload.onboard.network = 0
209

```

Normal text file      length: 9,141    lines: 214      Ln: 206    Col: 17    Pos: 8,780      Windows (CR LF)    UTF-8    IN

Figure 15.2. ArduPilot VSM configuration file

3. Connect the SkyHub to the drone and power on the system.
4. Launch the UgCS-CPM software on your computer.
5. Navigate to “Settings”, from the drop-down list select “SkyHub Autopilots” and enable “MAVLINK”.

---

**Note** Only one autopilot may be enabled at a time. In this case, DJI should be disabled.

---



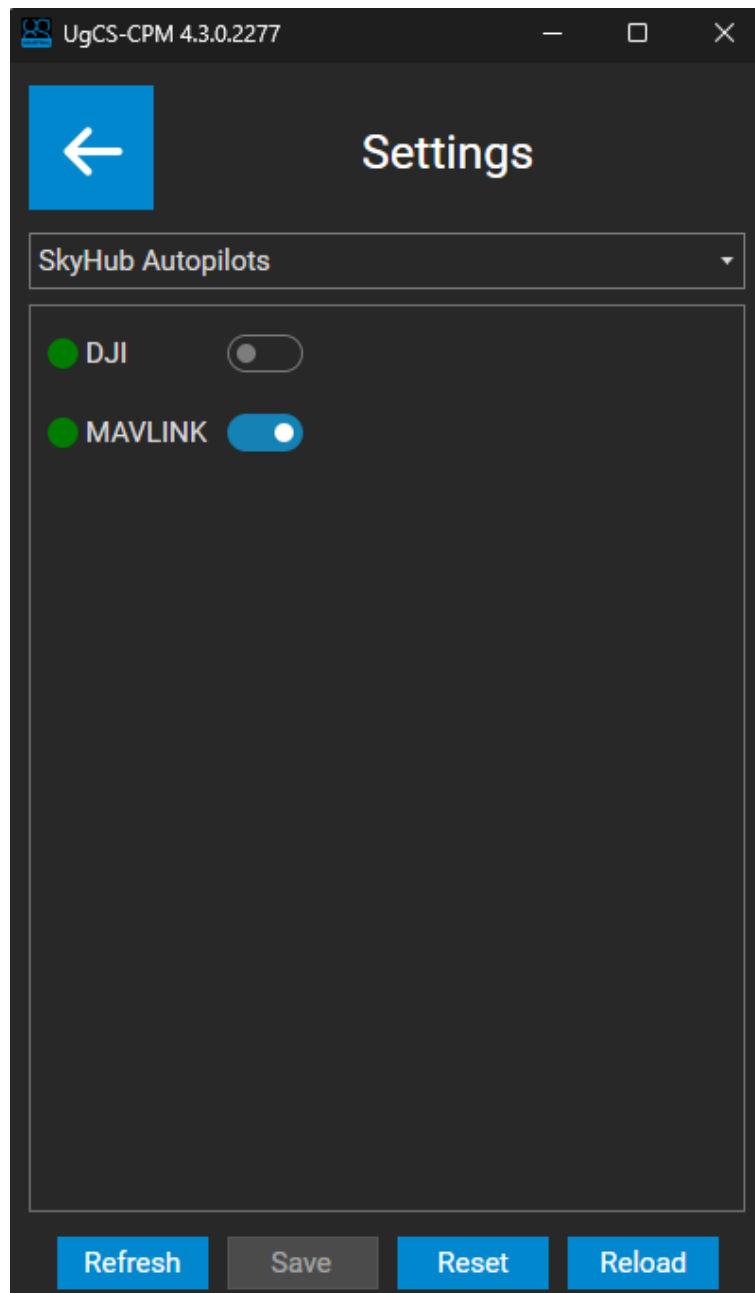


Figure 15.3. MAVLINK autopilot

6. Restart the system.
7. After the connection is reestablished, launch the UgCS-CPM and navigate to “Settings” and from the drop-down list select “MAVLink settings”.
8. Make sure that the UgCS ArduPilot VSM parameter `vehicle.ardupilot.custom_payload.onboard.component_id` is equal to the Component ID value in the MAVLink settings within the UgCS-CPM.
9. Make sure that the V2 Extension parameter is enabled.

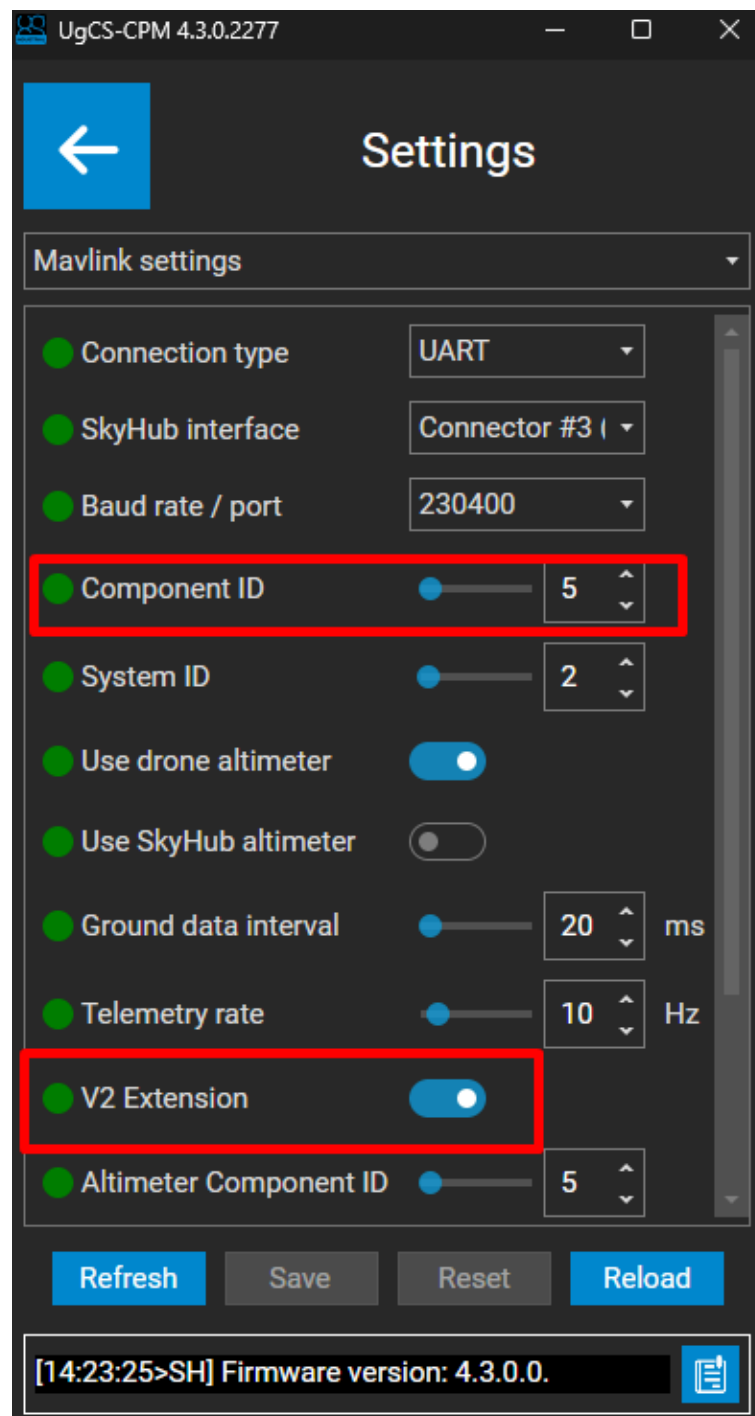


Figure 15.4. MAVLINK settings

10. Open the Mission Planner application, connect it to the vehicle autopilot and check the serial port settings used for SkyHub communication. Check the port configured baud rate. Speed should be the same as configured in the MAVLink settings within the UgCS-CPM (recommended 230400). If adjustment is needed, don't forget to write them and restart the autopilot.
11. Check communication between SkyHub and the autopilot. Using Mission Planner, open Setup -> Advanced -> MAVLink inspector.

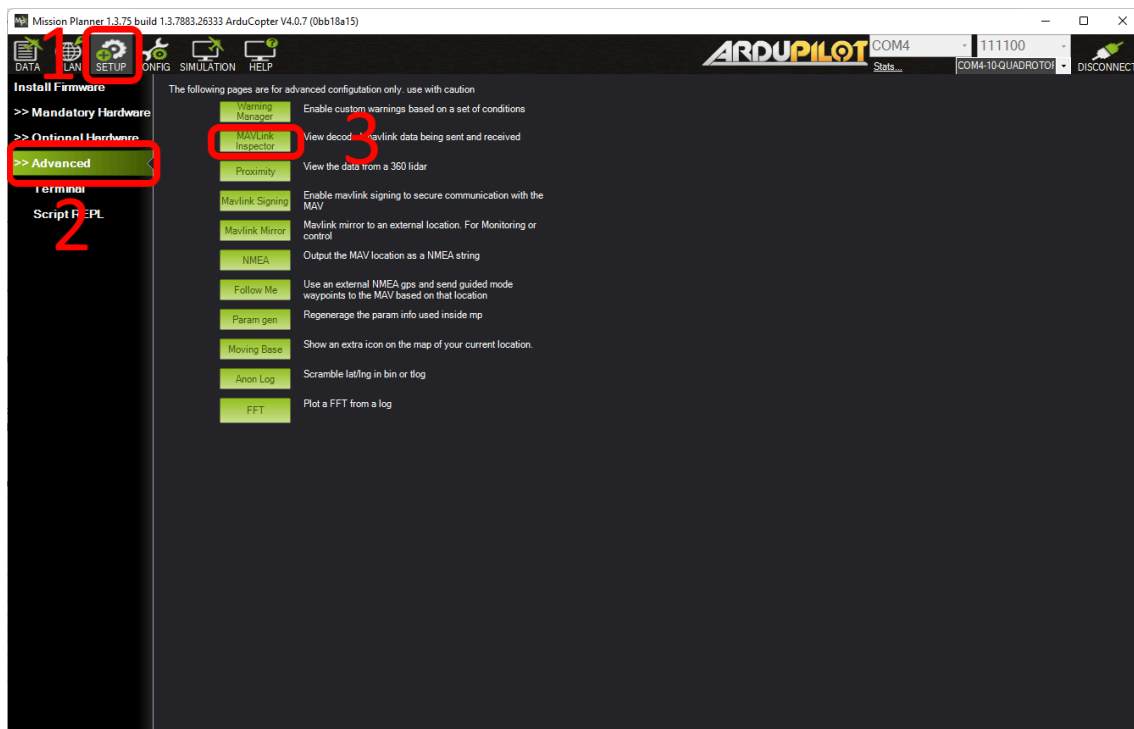


Figure 15.5. Mission Planner MAVlink inspector

12. In case of correct connection and configuration, the MAVLink inspector shows communication between SkyHub and the autopilot.

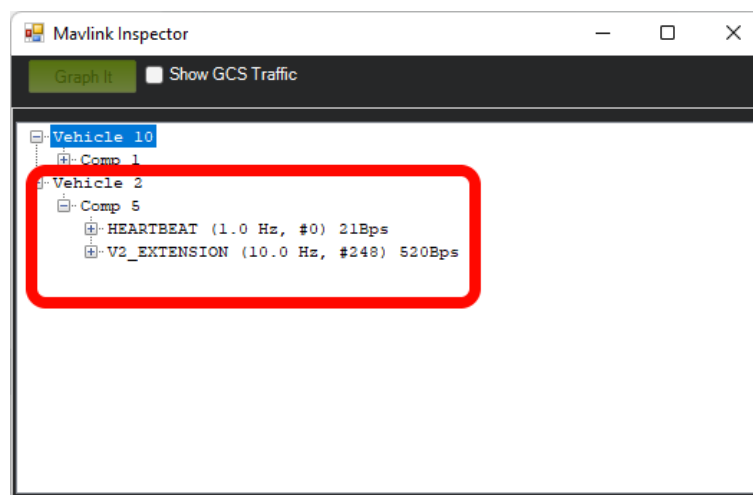


Figure 15.6. Mission Planner MAVlink inspector data

**Note** Vehicle 2 and Comp 5 correspond to System ID (2) and Component ID (5) fields in the MAVLink settings (UgCS-CPM).

13. In case of correct autopilot, UgCS and CPM configuration, *Payload data b64* is displayed in the drone telemetry in UgCS.

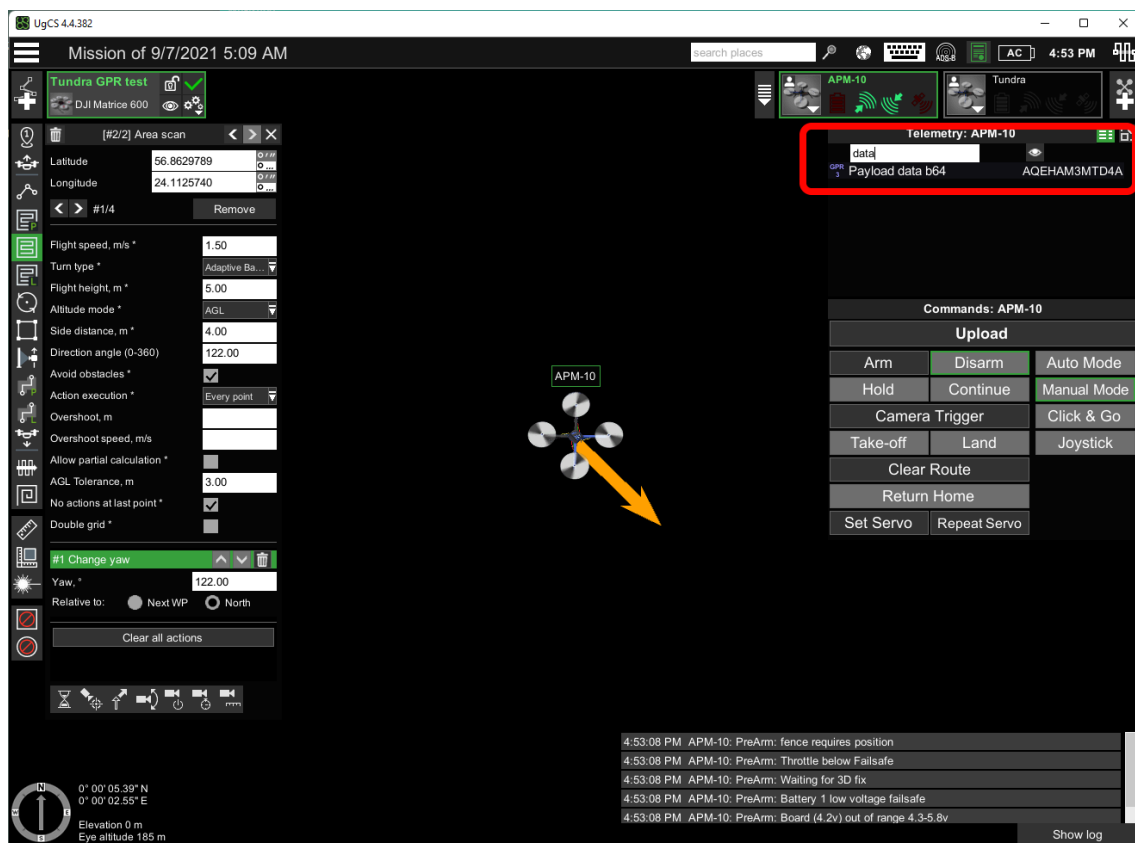


Figure 15.7. UgCS, drone telemetry

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## Setup Interface to PX4

---

SkyHub can be connected to the flight controller flashed with the PX4 1.10.x or higher firmware.

1. Make sure UgCS version 4.3 or higher is used (download links can be found in [Preparation](#) section) and VSM for PX4 vehicles is installed.

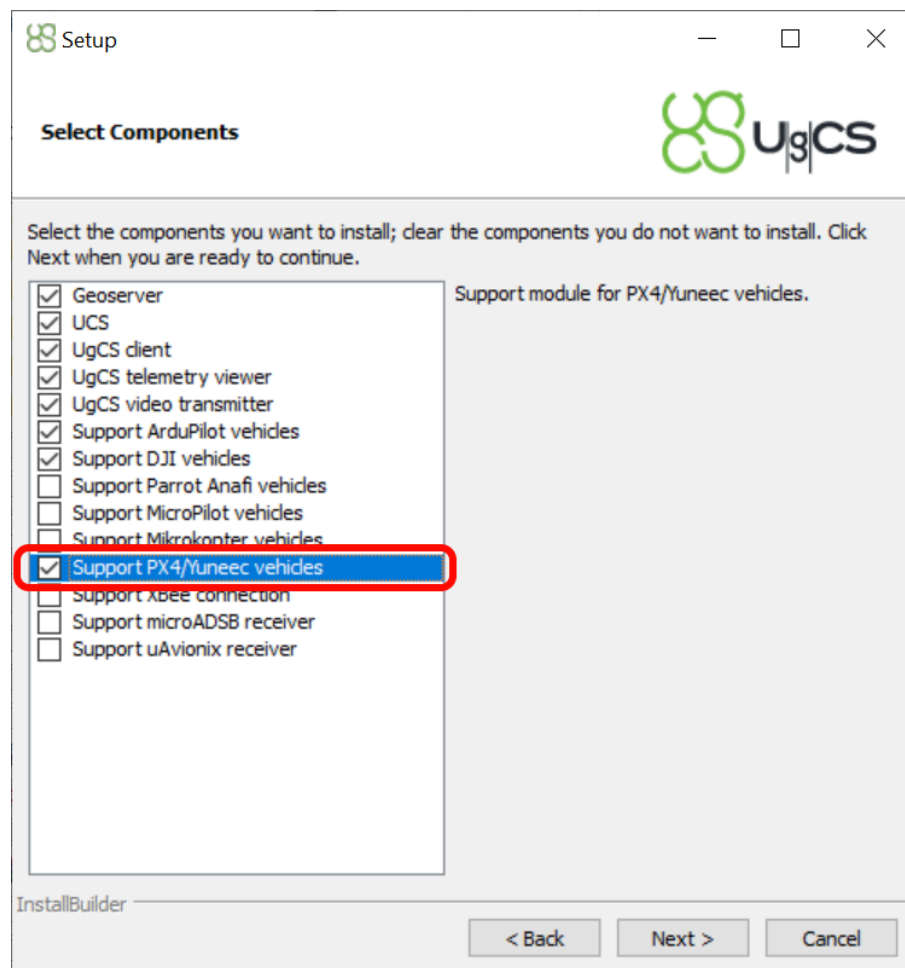


Figure 16.1. UgCS installation Support for PX4 based vehicles

2. Configure UgCS PX4 VSM. Open `vsm-px4.conf` in a text editor with administrator privileges. The file is located in the UgCS installation folder (default path `C:\Program Files (x86)\UgCS\bin`). Find, uncomment, and adjust the following settings if needed.

```

108 #vehicle.px4.telemetry_rate.VFR_HUD = 0.5
109
110 # Mavlink protocol version.
111 # Supported values:
112 # 1 : Always use mavlink version 1
113 # 2 : Always use mavlink version 2
114 # auto : Use mavlink 2 if autopilot reports mavlink2 capability
115 # Default: auto
116 vehicle.px4.mavlink_protocol_version = 2
117
118 # Set heading to next waypoint when heading is not specified for reout waypoint.
119 # no - do not use automatically calculated heading between waypoints. This disables override of parameter MIS_YAWMOI
120 # yes - force heading towards next waypoint when heading is not set in route. When set, each mission upload sets MIS_
121 # Default: yes
122 #vehicle.px4.autoheading = no
123
124 # Vehicle detection timeout. On new connection VSM will wait this long for data from the vehicle.
125 # Range: 1..100
126 # Default: 6
127 #vehicle.detection_timeout = 10
128
129 # Enable communication with onboard computer with custom payload functionality
130 # yes - communication is enabled. In this case onboard computer's system id and component id must be configured.
131 # Default: no
132 vehicle.px4.custom_payload.enable = yes
133
134 # MAVLINK system id of onboard computer with custom payload functionality.
135 # Range: 1 - 255
136 vehicle.px4.custom_payload.onboard.system_id = 2
137
138 # MAVLINK component id of onboard computer with custom payload functionality.
139 # Range: 1 - 255
140 vehicle.px4.custom_payload.onboard.component_id = 5
141
142 # MAVLINK network of onboard computer with custom payload functionality.
143 # Range: 0 - 255
144 # Default: 0
145 vehicle.px4.custom_payload.onboard.network = 0
146

```

Figure 16.2. PX4 VSM configuration file

3. Connect the SkyHub to the drone and power on the system.
4. Launch the UgCS-CPM software on your computer.
5. Navigate to “Settings”, from the drop-down list select “SkyHub Autopilots” and enable “MAVLINK”.

---

**Note** Only one autopilot may be enabled at a time. In this case, DJI should be disabled.

---

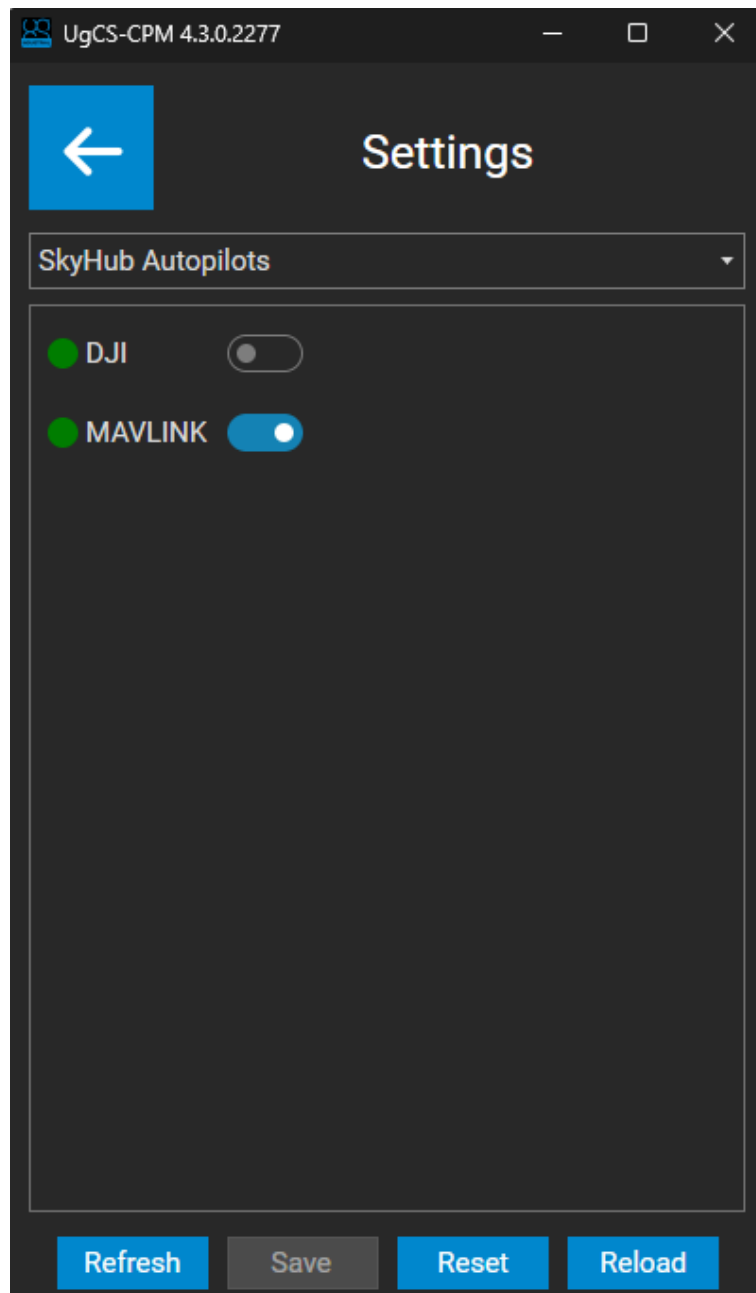


Figure 16.3. MAVLINK autopilot

6. Restart SkyHub.
7. Make sure that the UgCS PX4 VSM parameter `vehicle.px4.custom_payload.onboard.component_id` is equal to the Component ID value in the MAVLink settings within the UgCS-CPM.
8. Make sure that the V2 Extension parameter is enabled.

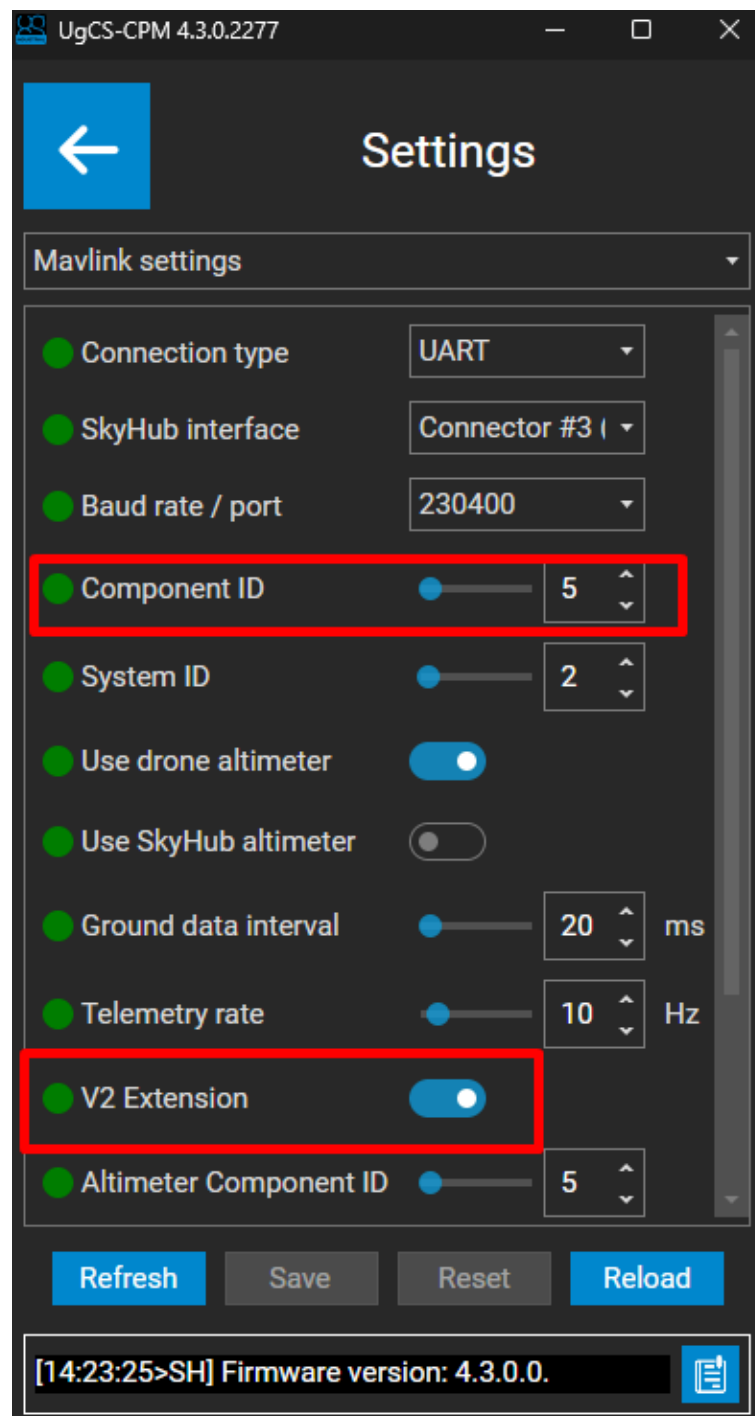


Figure 16.4. MAVLINK settings

9. If SkyHub is connected to telemetry port 2, open the QGroundControl application, then go to Parameters -> MAVLink and set the parameter MAV\_1\_CONFIG to TELEM2.



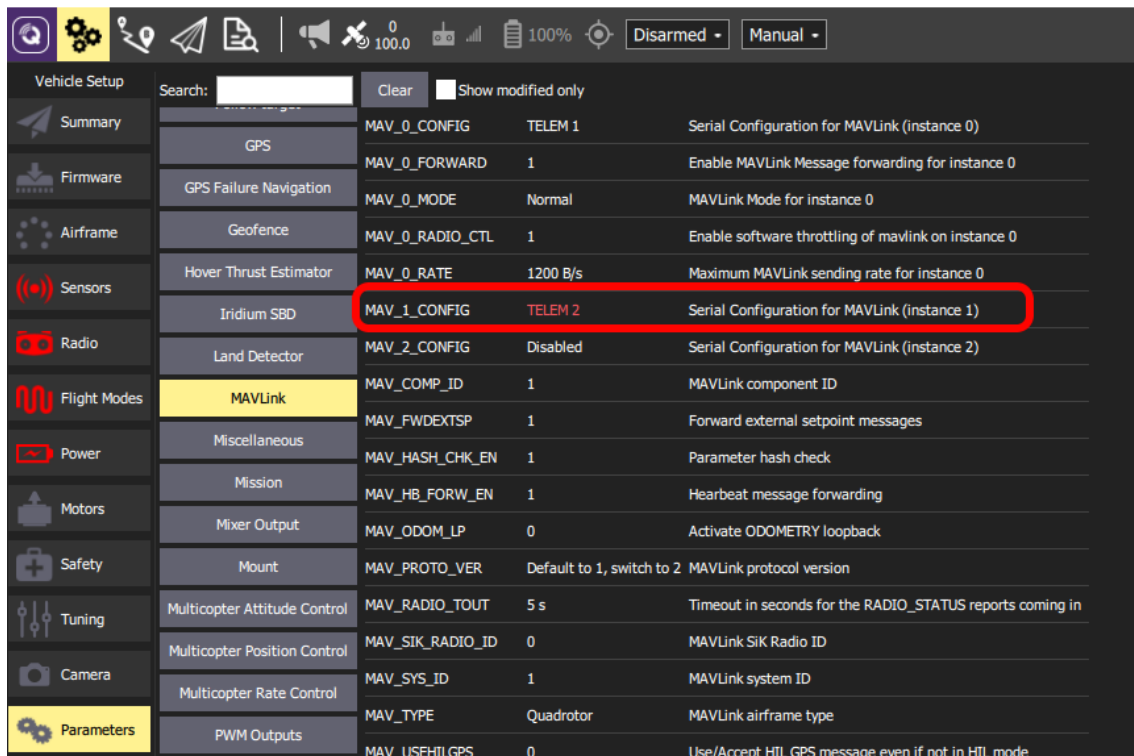


Figure 16.5. SkyHub PX4 TELEM2 port configuration

10. Restart the autopilot.
11. After restart, data forwarding for TELEM2 autopilot telemetry ports should be enabled. Set the parameter MAV\_1\_FORWARD to 1.

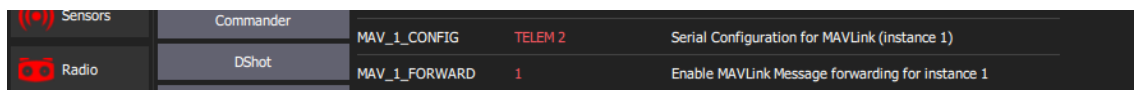


Figure 16.6. SkyHub PX4 TELEM2 port data forwarding configuration

12. Change the baud rate for the TELEM2 Serial Port (recommended 230400). Speed should be the same as configured on the SkyHub side in the MAVLink settings within the UgCS-CPM.

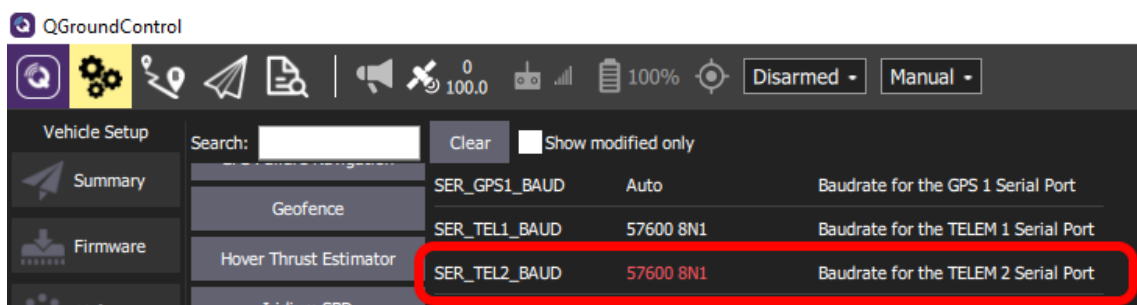


Figure 16.7. SkyHub PX4 TELEM2 port baudrate configuration

**Note** SkyHub subscribes to the following MAVLink messages with telemetry rate defined by the Telemetry

rate parameter in the MAVLink settings within the UgCS-CPM:

GPS2\_RAW; GPS\_RAW\_INT; GLOBAL\_POSITION\_INT; ATTITUDE; SYSTEM\_TIME; HEARTBEAT;  
DISTANCE\_SENSOR

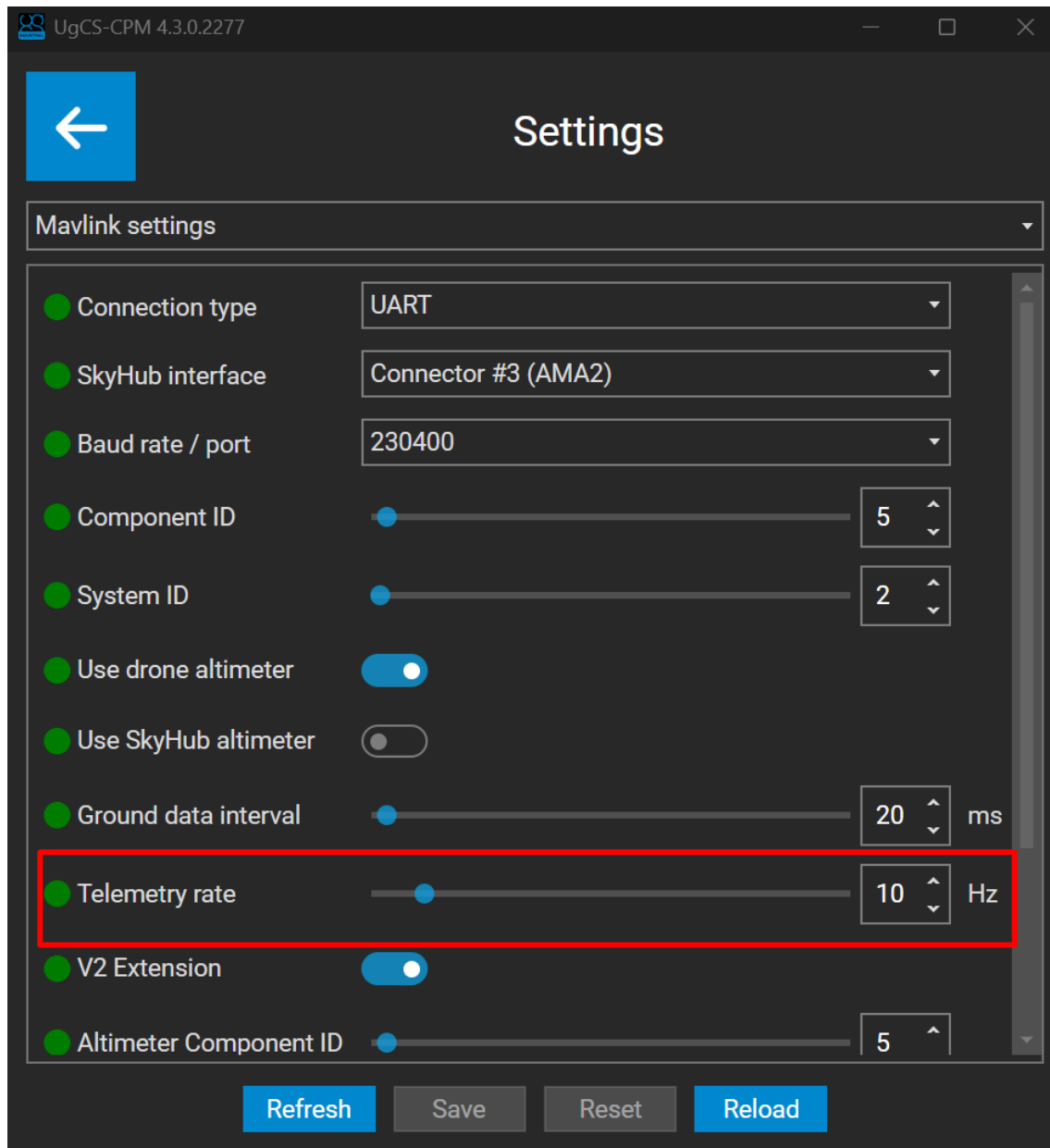


Figure 16.8. Mavlink telemetry rate

## Ainstein US-D1 Altimeter

**Note** The Sensor may be connected/disconnected only when the system is powered off.

- Attach the altimeter to the drone using the mountings provided with the sensor.
- Connect the cable to SkyHub Connector #1 (yellow).

Power on the system.

- Establish either the drone link or auxiliary connection with the SkyHub in the UgCS-CPM software.
- On the main screen of the UgCS-CPM, click on the “Payloads” button.
- From the available payload list, enable the “Altimeter Ainstein US-D1”.
- Press the “Save” button and confirm system reload.

Wait until the reload process is finished and the connection to the SkyHub is reestablished.

- On the main screen of the UgCS-CPM, click the “Start” button.
- From the drop-down widget list, select the “Altimeter Ainstein US-D1” and press the blue “plus” button.
- To access the configuration menu, press on the “three-dot” icon on the upper right corner of the widget and select “Settings”.

### 17.1 Ainstein US-D1 Altimeter Configuration Parameters

| Parameter     | Default             | Min | Max | Precision | Unit | Options                                                     | Description                                                                  |
|---------------|---------------------|-----|-----|-----------|------|-------------------------------------------------------------|------------------------------------------------------------------------------|
| Safe altitude | 5                   | 0.1 | 50  | 0.1       | m    |                                                             | Safe altitude drone will take in case of failsafe or at the end of the route |
| Baud rate     | 115200              |     |     |           | bps  | 57600, 115200, 230400                                       | Connection port baud rate, 115200 recommended by manufacturer                |
| Serial device | Connector #1 (AMA1) |     |     |           |      | Connector #1 (AMA1), Connector #2 (S0), Connector #4 (AMA3) | SkyHub connector number where sensor is connected                            |
| Payload Id    | 218                 | 192 | 220 | 1         |      |                                                             | Payload Id                                                                   |



## Lightware SF30/D Altimeter

**Note** The Sensor may be connected/disconnected only when the system is powered off.

- Attach the altimeter to the drone using the mountings provided with the sensor.
- Connect the cable to SkyHub Connector #1 (yellow).

Power on the system.

- Establish either the drone link or auxiliary connection with the SkyHub in the UgCS-CPM software.
- On the main screen of the UgCS-CPM, click on the “Payloads” button.
- From the available payload list, enable the “Altimeter Lightware SF30D”.
- Press the “Save” button and confirm system reload.

Wait until the reload process is finished and the connection to the SkyHub is reestablished.

- On the main screen of the UgCS-CPM, click the “Start” button.
- From the drop-down widget list, select the “Altimeter Lightware SF30D” and press the blue “plus” button.
- To access the configuration menu, press on the “three-dot” icon on the upper right corner of the widget and select “Settings”.

### 18.1 Lightware SF30/D Altimeter Configuration Parameters

| Parameter        | Default | Min | Max | Precision | Unit | Options                                               | Description                                                                  |
|------------------|---------|-----|-----|-----------|------|-------------------------------------------------------|------------------------------------------------------------------------------|
| Safe altitude    | 5       | 0.1 | 50  | 0.1       | m    |                                                       | Safe altitude drone will take in case of failsafe or at the end of the route |
| Extended CSV log | False   |     |     |           |      |                                                       | Create extended CSV log                                                      |
| Is filtered      | True    |     |     |           |      |                                                       | Use software filter for averaging values                                     |
| Rate Hz          | 39      |     |     |           | Hz   | 39, 78, 156, 312, 625, 1250, 2501, 5002, 10005, 20010 | Number of measurements per second                                            |

|               |                     |     |     |   |     |                                                             |                                                               |
|---------------|---------------------|-----|-----|---|-----|-------------------------------------------------------------|---------------------------------------------------------------|
| Return mode   | LAST                |     |     |   |     | FIRST, LAST                                                 | Which response to publish as an altitude value                |
| Baud rate     | 115200              |     |     |   | bps | 57600, 115200, 230400                                       | Connection port baud rate, 115200 recommended by manufacturer |
| Serial device | Connector #1 (AMA1) |     |     |   |     | Connector #1 (AMA1), Connector #2 (S0), Connector #4 (AMA3) | SkyHub connector number where altimeter is connected          |
| Payload Id    | 220                 | 192 | 220 | 1 |     |                                                             | Payload Id                                                    |

## Nanoradar NRA24 Altimeter

**Note** The Sensor may be connected/disconnected only when the system is powered off.

- Attach the altimeter to the drone using the mountings provided with the sensor.
- Connect the cable to SkyHub Connector #1 (yellow).

Power on the system.

- Establish either the drone link or auxiliary connection with the SkyHub in the UgCS-CPM software.
- On the main screen of the UgCS-CPM, click on the “Payloads” button.
- From the available payload list, enable the “Altimeter Nanoradar NRA24”.
- Press the “Save” button and confirm system reload.

Wait until the reload process is finished and the connection to the SkyHub is reestablished.

- On the main screen of the UgCS-CPM, click the “Start” button.
- From the drop-down widget list, select the “Altimeter Nanoradar NRA24” and press the blue “plus” button.
- To access the configuration menu, press on the “three-dot” icon on the upper right corner of the widget and select “Settings”.

### 19.1 Altimeter Nanoradar NRA24 Altimeter Configuration Parameters

| Parameter        | Default | Min | Max | Precision | Unit | Options            | Description                                                                                      |
|------------------|---------|-----|-----|-----------|------|--------------------|--------------------------------------------------------------------------------------------------|
| Safe altitude    | 5       | 0.1 | 50  | 0.1       | m    |                    | Safe altitude drone will take in case of failsafe or at the end of the route                     |
| Is filtered      | False   |     |     |           |      |                    | Use software filter for averaging values                                                         |
| Averaging factor | 2       |     |     |           |      | 1, 2, 4, 8, 16, 32 | Averaging factor. Larger value will make flight smoother but less accurate to elevation changes. |

|               |                     |     |     |   |     |                                                             |                                                               |
|---------------|---------------------|-----|-----|---|-----|-------------------------------------------------------------|---------------------------------------------------------------|
| Baud rate     | 115200              |     |     |   | bps | 57600, 115200, 230400                                       | Connection port baud rate, 115200 recommended by manufacturer |
| Serial device | Connector #1 (AMA1) |     |     |   |     | Connector #1 (AMA1), Connector #2 (S0), Connector #4 (AMA3) | SkyHub connector number where altimeter is connected          |
| Payload Id    | 219                 | 192 | 220 | 1 |     |                                                             | Payload Id                                                    |



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## Zond Aero NG & LF

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**Note** The GPR power cable may be connected/disconnected only when the system is powered off.

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- Connect the GPR power cable to SkyHub Power output port #7.
- Connect the GPR Ethernet cable to SkyHub Ethernet port #10.

Power on the system.

- Establish connection with SkyHub in UgCS-CPM.
- Open the Payloads list.
- Enable the GPR driver in the UgCS-CPM Payloads interface.
- GPR: Zond Aero NG & LF

Press “Save” in the Payloads interface and confirm system reload.

- Navigate to the main screen, press “Start” and add the GPR widget from the list.
- Access full configuration from Settings.

---

**Note** It is possible to configure GPR using Prism2 software when the GPR is connected to SkyHub. It is necessary to establish a connection with SkyHub over Wi-Fi and ensure that UgCS-CPM is closed before starting configuration in Prism2.

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### 20.1 Zond Aero NG & LF Configuration Parameters

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**Note** For large values of **Time range per sample** parameter, a valid **Tx PRF** frequency must be configured. If you encounter the message **Expected command confirmation line, got 'invalid'** in the UgCS-CPM log file while setting the Time range, it might indicate that the Time range value does not match a valid Tx PRF frequency configuration. To resolve this, adjust either the Time range or the Tx PRF frequency. To determine the correct frequency value, use Prism 2 software to configure and verify the settings before configuring SkyHub.

---

| Parameter   | Default | Min | Max  | Precision | Unit | Options | Description                                                    |
|-------------|---------|-----|------|-----------|------|---------|----------------------------------------------------------------|
| Pulse delay | 174     | 0   | 2000 | 1         |      |         | Pulse delay should be set up during the calibration in Prism2. |

|                       |                   |     |      |     |     |                                                                                                                                                                                                                                                                                |                                                                       |
|-----------------------|-------------------|-----|------|-----|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Time range per sample | 0.071 ns (#2)     |     |      |     |     | 0.018 ns (#0),<br>0.036 ns (#1),<br>0.071 ns (#2),<br>0.089 ns (#3),<br>0.125 ns (#4),<br>0.143 ns (#5),<br>0.179 ns (#6),<br>0.250 ns (#7),<br>0.357 ns (#8),<br>0.500 ns (#9),<br>0.625 ns (#10),<br>0.714 ns (#11),<br>1.000 ns (#12),<br>1.250 ns (#13),<br>2.500 ns (#14) | Encodes the trace time range per sample.                              |
| Sample count          | 512               |     |      |     |     | 32, 64, 128,<br>256, 512,<br>1024, 2048,<br>4096, 8192                                                                                                                                                                                                                         | Sample count per trace                                                |
| Stacking              | 128               |     |      |     |     | 4, 8, 16, 32,<br>64, 128, 256,<br>512, 1024,<br>2048, 4096,<br>8192, 16384,<br>32768, 65535                                                                                                                                                                                    | Defines how many traces are stacked.                                  |
| Tx PRF                | 299               | 1   | 310  | 1   | kHz |                                                                                                                                                                                                                                                                                | Transmission frequency, khz (Tx PRF)                                  |
| Cut off altitude, m   | 1.2               | 0.0 | 10.0 | 0.1 | m   |                                                                                                                                                                                                                                                                                | Cut off altitude limit for the transmitter.                           |
| Altitude source       | Default           |     |      |     |     | Lightware SF30D,<br>Ainstein US-D1,<br>Nanoradar NRA24,<br>Mavlink (autopilot),<br>Default                                                                                                                                                                                     | Altimeter that will be used for altitude data                         |
| Data log dir          | /data/skyhub_logs |     |      |     |     |                                                                                                                                                                                                                                                                                | Path on SkyHub storage where data is saved                            |
| Idle time, s          | 5                 | 0   | 100  | 1   | s   |                                                                                                                                                                                                                                                                                | Time before connection check if no data was received from the device. |
| Payload Id            | 212               | 192 | 220  | 1   |     |                                                                                                                                                                                                                                                                                | Payload Id                                                            |
| Raw log dir           |                   |     |      |     |     |                                                                                                                                                                                                                                                                                | Path on SkyHub storage where RAW log files are saved                  |

|                  |              |   |       |   |    |  |                                                                            |
|------------------|--------------|---|-------|---|----|--|----------------------------------------------------------------------------|
| IP address       | 192.168.0.10 |   |       |   |    |  | IP address of the device in the Ethernet network                           |
| TCP port         | 23           | 0 | 65535 | 1 |    |  | IP port to connect the device                                              |
| Telemetry period | 2000         | 0 | 10000 | 1 | ms |  | Telemetry data refresh rate, ms<br>How often to send the values to the CPM |



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## Zond Aero GPR

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**Note** The GPR power cable may be connected/disconnected only when the system is powered off.

---

- Connect the GPR power cable to SkyHub Power output port #7.
- Connect the GPR Ethernet cable to SkyHub Ethernet port #10.

Power on the system.

- Establish connection with SkyHub in UgCS-CPM.
- Open the Payloads list.
- Enable the GPR driver in the UgCS-CPM Payloads interface.
- GPR: Zond Aero.

Press “Save” in the Payloads interface and confirm system reload.

- Navigate to the main screen, press “Start” and add the GPR widget from the list.
- Access full configuration from Settings.

---

**Note** It is possible to configure GPR using Prism2 software when the GPR is connected to SkyHub. It is necessary to establish a connection with SkyHub over Wi-Fi and ensure that UgCS-CPM is closed before starting configuration in Prism2.

---

### 21.1 Zond Aero GPR Configuration Parameters

| Parameter           | Default | Min | Max  | Precision | Unit | Options                | Description                                                    |
|---------------------|---------|-----|------|-----------|------|------------------------|----------------------------------------------------------------|
| Time range          | 200     |     |      |           |      | 50, 100, 200, 300, 500 | Time range per sample, ns                                      |
| Pulse delay         | 174     | 0   | 2000 | 1         |      |                        | Pulse delay should be set up during the calibration in Prism2. |
| Cut off altitude, m | 1.2     | 0.0 | 10.0 | 0.1       | m    |                        | Cut off altitude limit for the transmitter.                    |

|                  |                   |     |       |   |    |                                                                                |                                                                            |
|------------------|-------------------|-----|-------|---|----|--------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| Altitude source  | Default           |     |       |   |    | Lightware SF30D, Ainstein US-D1, Nanoradar NRA24, Mavlink (autopilot), Default | Altimeter that will be used for altitude data                              |
| Data log dir     | /data/skyhub_logs |     |       |   |    |                                                                                | Path on SkyHub storage where data is saved                                 |
| Idle time, s     | 5                 | 0   | 100   | 1 | s  |                                                                                | Time before connection check if no data was received from the device.      |
| Payload Id       | 212               | 192 | 220   | 1 |    |                                                                                | Payload Id                                                                 |
| Raw log dir      | /data/skyhub_logs |     |       |   |    |                                                                                | Path on SkyHub storage where RAW log files are saved                       |
| IP address       | 192.168.0.10      |     |       |   |    |                                                                                | IP address of the device in the Ethernet network                           |
| TCP port         | 23                | 0   | 65535 | 1 |    |                                                                                | IP port to connect the device                                              |
| Telemetry period | 2000              | 0   | 10000 | 1 | ms |                                                                                | Telemetry data refresh rate, ms<br>How often to send the values to the CPM |

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## SBES: EchoLogger

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**Note** The Sensor may be connected/disconnected only when the system is powered off.

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- Attach the Universal Heavy Payload mount to the bottom of your drone.
- Attach the Echologger to the Universal Heavy Payload mount.
- Connect the cable to the SkyHub Connector #4 (white).

Power on the system.

- Establish either the drone link or auxiliary connection with the SkyHub in the UgCS-CPM software.
- On the main screen of the UgCS-CPM, click on the “Payloads” button.
- From the available payload list, enable the “SBES: EchoLogger”.
- Press the “Save” button and confirm system reload.

Wait until the reload process is finished and the connection to the SkyHub is reestablished.

- On the main screen of the UgCS-CPM, click the “Start” button.
- From the drop-down widget list, select the “SBES: EchoLogger single-frequency” if you have the ECT400 model, or “SBES: EchoLogger dual-frequency” if you have the D052S/D24S model, and press the blue “plus” button.
- To access the configuration menu, press on the “three-dot” icon on the upper right corner of the widget and select “Settings”.

### 22.1 SBES: EchoLogger NMEA output messages

- **GPRMC**: GPS coordinates output in NMEA0183
- **GPGGA**: GPS coordinates output in NMEA0183
- **GPZDA**: Date & Time (UTC, day, month, year, and local time zone)
- **SDDBT**: Depth Below Transducer (value expressed in feet, meters and fathoms)
- **SDDPT**: Depth (depth in meters, offset)
- **SDMTW**: Mean Temperature of Water (Water temperature in degrees centigrade)
- **YXXDR**: Pitch and roll in degrees (PTCH, ROLL)
- **SDXDR**: Hydromagic XDR sentence

## 22.2 SBES: EchoLogger Configuration Parameters (Single frequency)

| Parameter                | Default           | Min | Max   | Precision | Unit | Options                                                             | Description                                                                                 |
|--------------------------|-------------------|-----|-------|-----------|------|---------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Min depth                | 0.5               | 0.0 | 200.0 | 0.01      | m    |                                                                     | Higher value from sensor will appear red                                                    |
| Max depth                | 20.0              | 0.0 | 200.0 | 0.01      | m    |                                                                     | Lower value from sensor will appear red                                                     |
| Range                    | 10                |     |       |           | m    | 2, 3, 5, 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100, 120, 150, 200 | Maximum measurement range for high frequency                                                |
| Measurement interval     | 0.1               | 0.0 | 4.0   | 0.1       | s    |                                                                     | Measurement interval                                                                        |
| Output data mode         | NMEA              |     |       |           |      | NMEA, ECHOSOUNDER                                                   | NMEA: Output data in NMEA format only<br>ECHOSOUNDER: Output data in NMEA and SEG-Y formats |
| Sampling rate            | 0                 |     |       |           | Hz   | 0, 6250, 12500, 25000, 50000, 100000                                | Sensor internal sampling frequency, relevant only for ECHOSOUNDER mode                      |
| Gain                     | 0                 |     |       |           | dB   | +50, +40, +30, +20, +10, +6, 0, -6, -10, -20, -30, -40, -50         | Signal gain, dB                                                                             |
| Cable length             | 2.1               | 0.0 | 10.0  | 0.01      | m    |                                                                     | Distance from altimeter to bottom of echosounder                                            |
| Altimeter threshold      | 10                |     |       |           |      | 5, 10, 15, 20, 30, 40, 50, 60, 70                                   | Altimeter threshold in percents of a full scale                                             |
| Transmitted pulse length | 50                | 10  | 200   | 10        | us   |                                                                     | Transmission pulse length, microsecond                                                      |
| Dead zone                | 500               | 0   | 10000 | 1         | mm   |                                                                     | Near field zone where detection is ignored, mm                                              |
| Data log dir             | /data/skyhub_logs |     |       |           |      |                                                                     | Path on SkyHub storage where data is saved                                                  |



|                  |                   |     |     |     |        |                                                                                |                                                                                                     |
|------------------|-------------------|-----|-----|-----|--------|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| Max sensor angle | 20                | 0   | 90  | 1   | degree |                                                                                | The data are not recorded if the sensor tilt/roll value is greater than the specified value, degree |
| Sensor depth     | 0.1               | 0.0 | 1.0 | 0.1 | m      |                                                                                | Minimum sensor depth below water surface to record data in NMEA and SGY                             |
| Payload Id       | 192               | 192 | 220 | 1   |        |                                                                                | Payload Id                                                                                          |
| Raw log          | False             |     |     |     |        |                                                                                | Write raw data byte stream into separate log                                                        |
| Raw log path     | /data/skyhub_logs |     |     |     |        |                                                                                | Path to SkyHub storage for raw log files                                                            |
| Altitude source  | Default           |     |     |     |        | Lightware SF30D, Ainstein US-D1, Nanoradar NRA24, Mavlink (autopilot), Default | Altimeter that will be used for altitude data                                                       |
| UART baud rate   | 115200            |     |     |     | bps    | 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600                | Connection port baud rate, 115200 recommended by manufacturer                                       |
| Serial device    | Connector #4      |     |     |     |        | Connector #4, Connector #5                                                     | SkyHub connector number where altimeter is connected                                                |

## 22.3 SBES: EchoLogger Configuration Parameters (Dual frequency)

| Parameter  | Default | Min | Max   | Precision | Unit | Options                                                             | Description                                  |
|------------|---------|-----|-------|-----------|------|---------------------------------------------------------------------|----------------------------------------------|
| Min depth  | 0.5     | 0.0 | 200.0 | 0.01      | m    |                                                                     | Higher value from sensor will appear red     |
| Max depth  | 20.0    | 0.0 | 200.0 | 0.01      | m    |                                                                     | Lower value from sensor will appear red      |
| Range high | 10      |     |       |           | m    | 2, 3, 5, 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100, 120, 150, 200 | Maximum measurement range for high frequency |
| Range low  | 10      |     |       |           | m    | 2, 3, 5, 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100, 120, 150, 200 | Maximum measurement range for low frequency  |

|                               |      |     |       |      |    |                                                             |                                                                                             |
|-------------------------------|------|-----|-------|------|----|-------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| Measurement interval          | 0.1  | 0.0 | 4.0   | 0.1  | s  |                                                             | Measurement interval                                                                        |
| Output data mode              | NMEA |     |       |      |    | NMEA, ECHOSOUNDER                                           | NMEA: Output data in NMEA format only<br>ECHOSOUNDER: Output data in NMEA and SEG-Y formats |
| Sampling rate                 | 0    |     |       |      | Hz | 0, 6250, 12500, 25000, 50000, 100000                        | Sensor internal sampling frequency, relevant only for ECHOSOUNDER mode                      |
| Gain high                     | 0    |     |       |      | dB | +50, +40, +30, +20, +10, +6, 0, -6, -10, -20, -30, -40, -50 | Signal gain for high frequency channel, dB                                                  |
| Gain low                      | 0    |     |       |      | dB | +50, +40, +30, +20, +10, +6, 0, -6, -10, -20, -30, -40, -50 | Signal gain for low frequency channel, dB                                                   |
| Cable length                  | 2.1  | 0.0 | 10.0  | 0.01 | m  |                                                             | Distance from altimeter to bottom of echosounder                                            |
| Altimeter threshold high      | 10   |     |       |      |    | 5, 10, 15, 20, 30, 40, 50, 60, 70                           | Altimeter threshold in percents of a full scale for high frequency                          |
| Altimeter threshold low       | 10   |     |       |      |    | 5, 10, 15, 20, 30, 40, 50, 60, 70                           | Altimeter threshold in percents of a full scale for low frequency                           |
| Transmitted pulse length high | 50   | 10  | 200   | 1    | us |                                                             | Transmission pulse length for high frequency channel, microsecond                           |
| Transmitted pulse length low  | 50   | 10  | 200   | 1    | us |                                                             | Transmission pulse length for low frequency channel, microsecond                            |
| Dead zone, high               | 300  | 150 | 10000 | 1    | mm |                                                             | Near field zone where detection is ignored for high acoustic frequency, mm                  |

|                  |                   |     |       |     |        |                                                                                |                                                                                                     |
|------------------|-------------------|-----|-------|-----|--------|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| Dead zone, low   | 1000              | 500 | 10000 | 1   | mm     |                                                                                | Near field zone where detection is ignored for low acoustic frequency, mm                           |
| Data log dir     | /data/skyhub_logs |     |       |     |        |                                                                                | Path on SkyHub storage where data is saved                                                          |
| Max sensor angle | 20                | 0   | 90    | 1   | degree |                                                                                | The data are not recorded if the sensor tilt/roll value is greater than the specified value, degree |
| Sensor depth     | 0.1               | 0.0 | 1.0   | 0.1 | m      |                                                                                | Minimum sensor depth below water surface to record data in NMEA and SGY                             |
| Payload Id       | 192               | 192 | 220   | 1   |        |                                                                                | Payload Id                                                                                          |
| Raw log          | False             |     |       |     |        |                                                                                | Write raw data byte stream into separate log                                                        |
| Raw log path     | /data/skyhub_logs |     |       |     |        |                                                                                | Path to SkyHub storage for raw log files                                                            |
| Altitude source  | Default           |     |       |     |        | Lightware SF30D, Ainstein US-D1, Nanoradar NRA24, Mavlink (autopilot), Default | Altimeter that will be used for altitude data                                                       |
| UART baud rate   | 115200            |     |       |     | bps    | 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600                | Connection port baud rate, 115200 recommended by manufacturer                                       |
| Serial device    | Connector #4      |     |       |     |        | Connector #4, Connector #5                                                     | SkyHub connector number where altimeter is connected                                                |



## EchoNIMBUS MBES

**Note** The Sensor may be connected/disconnected only when the system is powered off.

- Attach the Universal Heavy Payload mount to the bottom of your drone.
- Attach the payload to the Universal Heavy Payload mount.
- Connect the power cable to the SkyHub power output port #7.
- Connect the Ethernet cable to the SkyHub Ethernet port #10.

Power on the system.

- Establish either the drone link or auxiliary connection with the SkyHub in the UgCS-CPM software.
- On the main screen of the UgCS-CPM, click on the “Payloads” button.
- From the available payload list, enable the “MBES: Cerulean Surveyor”.
- Press the “Save” button and confirm system reload.

Wait until the reload process is finished and the connection to the SkyHub is reestablished.

- On the main screen of the UgCS-CPM, click the “Start” button.
- From the drop-down widget list, select the “MBES: Cerulean Surveyor” and press the blue “plus” button.
- To access the configuration menu, press on the “three-dot” icon on the upper right corner of the widget and select “Settings”.

### 23.1 EchoNIMBUS MBES Configuration Parameters

| Parameter            | Default | Min | Max   | Precision | Unit | Options | Description                                |
|----------------------|---------|-----|-------|-----------|------|---------|--------------------------------------------|
| Min depth            | 0.5     | 0.0 | 100.0 | 0.1       | m    |         | Minimum depth                              |
| Max depth            | 20.0    | 0.0 | 100.0 | 0.1       | m    |         | Maximum depth                              |
| Measurement interval | 0.1     | 0.0 | 5.0   | 0.1       | s    |         | Measurement interval                       |
| Range                | 10      | 0   | 100   | 1         | m    |         | Maximal readings range threshold in meters |
| Gain                 | -1      | -1  | 10    | 1         | dB   |         | Signal gain, dB                            |
| Speed of sound       | 1481    | 0   | 5000  | 1         | mps  |         | Speed of sound, m/s                        |

|                  |                   |     |       |     |        |                                                                                |                                                                                                     |
|------------------|-------------------|-----|-------|-----|--------|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| Deadzone         | 300               | 0   | 1000  | 1   | mm     |                                                                                | Sensor deadzone, mm                                                                                 |
| Pulse duration   | 0                 | 0   | 1000  | 1   | us     |                                                                                | Pulse durations, us Value 0 for automatic selection                                                 |
| Max sensor angle | 180               | 0   | 180   | 1   | degree |                                                                                | The data are not recorded if the sensor tilt/roll value is greater than the specified value, degree |
| Min sensor depth | 0.1               | 0.0 | 1.0   | 0.1 | m      |                                                                                | Minimum sensor depth below water surface                                                            |
| Altitude source  | Default           |     |       |     |        | Lightware SF30D, Ainstein US-D1, Nanoradar NRA24, Mavlink (autopilot), Default | Altimeter that will be used for altitude data                                                       |
| Data log dir     | /data/skyhub_logs |     |       |     |        |                                                                                | Path on SkyHub storage where data is saved                                                          |
| IP address       | 192.168.0.10      |     |       |     |        |                                                                                | IP address of the device in the Ethernet network                                                    |
| TCP Port         | 62312             | 0   | 65535 | 1   |        |                                                                                | TCP-port of the sensor                                                                              |
| NTP IP address   | 192.168.0.33      |     |       |     |        |                                                                                | NTP server IP address                                                                               |
| Range resolution | 200               | 1   | 1000  | 1   | m      |                                                                                | Range resolution in number of range steps                                                           |
| Pulse length     | 1.5               | 0.0 | 10.0  | 0.1 | m      |                                                                                | Pulse length in number of range steps                                                               |
| Payload Id       | 192               | 192 | 220   | 1   |        |                                                                                | Payload Id                                                                                          |

## EchoNIMBUS SSS

**Note** The Sensor may be connected/disconnected only when the system is powered off.

- Attach the Universal Heavy Payload mount to the bottom of your drone.
- Attach the EchoNIMBUS to the Universal Heavy Payload mount.
- Connect the power cable to the SkyHub power output port #7.
- Connect the Ethernet cable to the SkyHub Ethernet port #10.

Power on the system.

- Establish either the drone link or auxiliary connection with the SkyHub in the UgCS-CPM software.
- On the main screen of the UgCS-CPM, click on the “Payloads” button.
- From the available payload list, enable the “Cerulean Omniscan 450”.
- Press the “Save” button and confirm system reload.

Wait until the reload process is finished and the connection to the SkyHub is reestablished.

- On the main screen of the UgCS-CPM, click the “Start” button.
- From the drop-down widget list, select the “Cerulean Omniscan 450” and press the blue “plus” button.
- To access the configuration menu, press on the “three-dot” icon on the upper right corner of the widget and select “Settings”.

### 24.1 EchoNIMBUS SSS Configuration Parameters

| Parameter | Default | Min | Max   | Precision | Unit | Options | Description                                                             |
|-----------|---------|-----|-------|-----------|------|---------|-------------------------------------------------------------------------|
| Min depth | 0.5     | 0.0 | 100.0 | 0.1       | m    |         | If data is lower than this parameter + 1, the value will be red in CPM  |
| Max depth | 20.0    | 0.0 | 100.0 | 0.1       | m    |         | If data is bigger than this parameter - 1, the value will be red in CPM |

|                      |                   |     |       |      |     |                                                                                |                                                                             |
|----------------------|-------------------|-----|-------|------|-----|--------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| Measurement interval | 0.1               | 0.0 | 100.0 | 0.1  | s   |                                                                                | Wave emission interval in seconds                                           |
| Range                | 20                | 0   | 100   | 1    | m   |                                                                                | Maximal readings range threshold in meters                                  |
| Gain                 | -1                | -1  | 7     | 1    | dB  |                                                                                | Set the sensor's gain. -1 value is for automatic mode.                      |
| Speed of sound       | 1481              | 0   | 10000 | 1    | mps |                                                                                | Speed of sound in the target environment, m/s                               |
| Deadzone             | 300               | 0   | 10000 | 1    | mm  |                                                                                | Set the sensor's deadzone in mm. Start range at which echo data is recorded |
| Altitude source      | Default           |     |       |      |     | Lightware SF30D, Ainstein US-D1, Nanoradar NRA24, Mavlink (autopilot), Default | Select the altimeter as a source of height above surface                    |
| Data log dir         | /data/skyhub_logs |     |       |      |     |                                                                                | Path on SkyHub storage where to put the log files in SVLOG format           |
| IP address left      | 192.168.0.11      |     |       |      |     |                                                                                | Left sensor's IP address to connect                                         |
| IP address right     | 192.168.0.10      |     |       |      |     |                                                                                | Right sensor's IP address to connect                                        |
| TCP Port             | 51200             | 0   | 65535 | 1    |     |                                                                                | Sensor's TCP port to connect                                                |
| Min sensor depth     | 0.1               | 0.0 | 100.0 | 0.1  | m   |                                                                                | Minimal reading depth threshold in meters                                   |
| Mounting length      | 0.6               | 0.0 | 100.0 | 0.01 | m   |                                                                                | Mounting cable or arm length in meters                                      |
| Pulse length         | 0.2               | 0.0 | 100.0 | 0.1  | %   |                                                                                | % of total ping time for current range. 0.2 is typical.                     |
| Filter duration      | 0.15              | 0.0 | 100.0 | 0.1  | %   |                                                                                | Filter duration. 0.15 is typical.                                           |



|                        |      |      |      |   |        |  |                                                   |
|------------------------|------|------|------|---|--------|--|---------------------------------------------------|
| Signal data points     | 1200 | 200  | 1200 | 1 |        |  | Number of signal data points in resulting profile |
| Left transducer angle  | -90  | -180 | 180  | 1 | degree |  | Angle of sight of the left transducer, degree     |
| Right transducer angle | 90   | -180 | 180  | 1 | degree |  | Angle of sight of the right transducer, degree    |
| Payload Id             | 192  | 192  | 220  | 1 |        |  | Payload Id                                        |



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## Magnetometer MagNIMBUS

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MagNIMBUS comes in two possible configurations:

1. Single sensor (beneath the drone) with foldable mount.
2. Gradiometer.

**Warning** During system power-on, the sensor must be physically mounted on the drone. If the sensor is laying sideways on a table during power-on, it might not finish the calibration successfully.

### 25.1 Single sensor assembly

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**Note** The Sensor may be connected/disconnected only when the system is powered off.

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- Attach the Universal Heavy Payload mount to the bottom of your drone.
- Attach the magnetometer to the Universal Heavy Payload mount.
- Connect the cable to SkyHub Connector #4 (white).

Power on the system.

- Establish either the drone link or auxiliary connection with the SkyHub in the UgCS-CPM software.
- On the main screen of the UgCS-CPM, click on the “Payloads” button.
- From the available payload list, enable the “Magnetometer:MagNIMBUS”.
- Press the “Save” button and confirm system reload.

Wait until the reload process is finished and the connection to the SkyHub is reestablished.

- On the main screen of the UgCS-CPM, click the “Start” button.
- From the drop-down widget list, select the “Magnetometer:MagNIMBUS” and press the blue “plus” button.
- To access the configuration menu, press on the “three-dot” icon on the upper right corner of the widget and select “Settings”.

### 25.2 Gradiometer assembly

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**Note** The Sensor may be connected/disconnected only when the system is powered off.

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- Attach the Universal Heavy Payload mount to the bottom of your drone.
- Attach the magnetometer to the Universal Heavy Payload mount.
- Connect the cable to SkyHub Connector #4 (white).
- Attach vertical mast on the left side of the drone.

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**Note** Vertical mast has two points of contact:

1. Upper mount (in the shape of an arrow) should be attached to the top panel of the drone.
  2. Lower mount (in the shape of a regular clip) should be attached to the leg of the drone.
- 

- Connect the USB cable to the SkyHub USB port #11 (white).

Power on the system.

- Establish either the drone link or auxiliary connection with the SkyHub in the UgCS-CPM software.
- On the main screen of the UgCS-CPM, click on the “Payloads” button.
- From the available payload list, enable the “Magnetometer:MagNIMBUS”.
- Press the “Save” button and confirm system reload.

Wait until the reload process is finished and the connection to the SkyHub is reestablished.

- On the main screen of the UgCS-CPM, click the “Start” button.
- From the drop-down widget list, select the “Magnetometer:MagNIMBUS” and press the blue “plus” button.
- To access the configuration menu, press on the “three-dot” icon on the upper right corner of the widget and select “Settings”.
- Within the settings menu, navigate to the “Secondary connector” field and from the drop-down list select the USB port used for the mast.

## 25.3 Magnetometer MagNIMBUS Configuration Parameters

| Parameter            | Default | Min | Max | Precision | Unit | Options                              | Description                                                                                                                                                                                  |
|----------------------|---------|-----|-----|-----------|------|--------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sensor data rate     | 4       |     |     |           | ms   | 2, 4, 8, 16, 32, 64, 128, 1000, 2000 | Time in ms between measurements output. 1ms corresponds to 1kHz output frequency (should be set port baud rate 230400). 4ms corresponds to 250Hz, an adequate setting for most applications. |
| Magnetic environment | AVERAGE |     |     |           |      | AVERAGE, QUIET, NOISY                | Optimizes sensor for the magnetic environment                                                                                                                                                |

|                          |         |     |     |      |   |                                                                                            |                                                                                                                                                                                                                                                   |
|--------------------------|---------|-----|-----|------|---|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Filter mode              | OFF     |     |     |      |   | OFF,<br>NOTCH_50HZ,<br>NOTCH_60HZ,<br>HP_10HZ,<br>HP_20HZ,<br>LP_10HZ,<br>LP_20HZ          | The command to change filter mode must be sent to all connected sensors as they can store configurations. OFF - all filters disabled. LP_05, LP_10, LP_20 - low-pass filters with cut-off frequency 05, 10, 20 Hz                                 |
| Data log dir             |         |     |     |      |   |                                                                                            | Specifies the log path to record raw data. If empty, no data is recorded                                                                                                                                                                          |
| Accelerometer log        | ON      |     |     |      |   | ON, OFF                                                                                    | Enables logging of IMU's accelerometer data.                                                                                                                                                                                                      |
| Gyroscope data stream    | OFF     |     |     |      |   | ON, OFF                                                                                    | Enables streaming of IMU's gyroscope data.                                                                                                                                                                                                        |
| Magnetometer data stream | OFF     |     |     |      |   | ON, OFF                                                                                    | Enables streaming of IMU's vector magnetometer data.                                                                                                                                                                                              |
| Temperature data stream  | OFF     |     |     |      |   | ON, OFF                                                                                    | Enables streaming of IMU's temperature data.                                                                                                                                                                                                      |
| Vector mode              | ON      |     |     |      |   | ON, OFF                                                                                    | The sensor reports Total field only (VECTOR_MODE=OFF) or Total field + XYZ components                                                                                                                                                             |
| Offset forward           | 0.0     | 0.0 | 2.0 | 0.01 | m |                                                                                            | The offset of the sensor N alongside the heading line, m Offset is calculated relative to the center of the GPS antenna or relative to the point for which coordinates are reported in 2x GPS antenna configurations like for DJI M350/M300 RTK.  |
| Offset right             | 0.0     | 0.0 | 2.0 | 0.01 | m |                                                                                            | The offset of the sensor N alongside the traverse line, m Offset is calculated relative to the center of the GPS antenna or relative to the point for which coordinates are reported in 2x GPS antenna configurations like for DJI M350/M300 RTK. |
| Altitude source          | Default |     |     |      |   | Lightware SF30D,<br>Ainstein US-D1,<br>Nanoradar NRA24,<br>Mavlink (autopilot),<br>Default | Altimeter that will be used for altitude data                                                                                                                                                                                                     |

|                     |                     |     |     |   |     |                                                                                                         |                                                               |
|---------------------|---------------------|-----|-----|---|-----|---------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| Primary connector   | Connector #4 (AMA3) |     |     |   |     | USB 1, USB 2, Connector #1 (AMA1), Connector #2 (S0), Connector #3 (AMA2), Connector #4 (AMA3)          | SkyHub connector for Primary sensor                           |
| Secondary connector | <empty>             |     |     |   |     | <empty>, USB 1, USB 2, Connector #1 (AMA1), Connector #2 (S0), Connector #3 (AMA2), Connector #4 (AMA3) | SkyHub connector for Secondary sensor                         |
| UART baud rate      | 230400              |     |     |   | bps | 115200, 230400                                                                                          | Connection port baud rate, 230400 recommended by manufacturer |
| Payload Id          | 192                 | 192 | 220 | 1 |     |                                                                                                         | Payload Id                                                    |

## Magnetometer MagDrone R1

**Note** The Sensor may be connected/disconnected only when the system is powered off.

- Attach the Universal Heavy Payload mount to the bottom of your drone.
- Attach the magnetometer to the Universal Heavy Payload mount.
- Connect the USB data cable to SkyHub USB port #11.
- Connect the power cable to SkyHub power output port #7.

Power on the system.

- Establish either the drone link or auxiliary connection with the SkyHub in the UgCS-CPM software.
- On the main screen of the UgCS-CPM, click on the “Payloads” button.
- From the available payload list, enable the “Magnetometer:MagDrone R1”.
- Press the “Save” button and confirm system reload.

Wait until the reload process is finished and the connection to the SkyHub is reestablished.

- On the main screen of the UgCS-CPM, click the “Start” button.
- From the drop-down widget list, select the “Magnetometer:MagDrone R1” and press the blue “plus” button.
- To access the configuration menu, press on the “three-dot” icon on the upper right corner of the widget and select “Settings”.

### 26.1 Magnetometer MagDrone R1 Configuration Parameters

| Parameter     | Default | Min | Max | Precision | Unit | Options      | Description                                                                                               |
|---------------|---------|-----|-----|-----------|------|--------------|-----------------------------------------------------------------------------------------------------------|
| Configuration | SINGLE  |     |     |           |      | SINGLE, DUAL | SINGLE - mag sensor connected to port 1 of TDD ADC<br>DUAL - 2x sensors connected to ports 1&2 of TDD ADC |
| Sensor type   | 2       |     |     |           |      | 1, 2         | Corresponds to PROBE command of TDD protocol. PROBE;1;2 (default value for R1).                           |

|                   |         |     |     |      |     |                                                                                |                                                                                                                                                                                                                                           |
|-------------------|---------|-----|-----|------|-----|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sensor data rate  | 250     |     |     |      | Hz  | 200, 250                                                                       | Sampling rate of the sensor (number of measurements per second)                                                                                                                                                                           |
| Downsampling      | 0       | 0   | 100 | 1    | ms  |                                                                                | 0 - disabled 1 - disabled as well 2 - every 2 measurements will be outputted as 1 ... 100 - every 100 measurements will be outputted once                                                                                                 |
| Downsampling type | Average |     |     |      |     | Average, Last sample, MAX ABS                                                  | Downsampling type                                                                                                                                                                                                                         |
| Offset forward    | 0.0     | 0.0 | 2.0 | 0.01 | m   |                                                                                | The offset of the sensor alongside the heading line, m Offset is calculated relative to the center of the GPS antenna or relative to the point for which coordinates are reported in 2x GPS antenna configurations like for DJI M300 RTK. |
| Altitude source   | Default |     |     |      |     | Lightware SF30D, Ainstein US-D1, Nanoradar NRA24, Mavlink (autopilot), Default | Altimeter that will be used for altitude data                                                                                                                                                                                             |
| SkyHub connector  | USB 1   |     |     |      |     | Connector #4 (AMA3), Connector #5 (AMA4), USB 1, USB 2                         | SkyHub connector 4 or 5, USB port                                                                                                                                                                                                         |
| Baud rate         | 921600  |     |     |      | bps | 115200, 230400, 921600                                                         | Connection port baud rate, 230400 recommended by manufacturer                                                                                                                                                                             |
| Payload Id        | 192     | 192 | 220 | 1    |     |                                                                                | Payload Id                                                                                                                                                                                                                                |



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## Laser Falcon 1 / 2 Methane Detector

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**Note** The Sensor may be connected/disconnected only when the system is powered off.

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### 27.1 Laser Falcon 1 setup

- Attach the mountings to the frame of the Laser Falcon sensor.
- Mount the sensor on the leg of the drone. Make sure that all three points of contact are secured.
- Connect the payload with the micro USB B-type cable to the SkyHub power out connector #7.
- Connect the data transfer cable with the mini USB B-type cable to the SkyHub USB port 1 or 2 #11.

Power on the system.

- Establish either the drone link or auxiliary connection with the SkyHub in the UgCS-CPM software.
- On the main screen of the UgCS-CPM, click on the “Payloads” button.
- From the available payload list, enable the “Laser Falcon 1 / 2 methane detector”.
- Press the “Save” button and confirm system reload.

Wait until the reload process is finished and the connection to the SkyHub is reestablished.

- On the main screen of the UgCS-CPM, click the “Start” button.
- From the drop-down widget list, select the “Laser Falcon 1 / 2 methane detector” and press the blue “plus” button.
- To access the configuration menu, press on the “three-dot” icon on the upper right corner of the widget and select “Settings”.
- Within the “Settings”, navigate to the “Serial device” field and change its value to “Connector USB1” or “Connector USB2”, according to which USB connector the sensor is plugged into on SkyHub.

### 27.2 Laser Falcon 2 setup

- Attach the mountings to the frame of the Laser Falcon sensor.
- Mount the sensor on the leg of the drone. Make sure that all three points of contact are secured.
- Connect the cable to the SkyHub Connector #4 (white).

Power on the system.

- Establish either the drone link or auxiliary connection with the SkyHub in the UgCS-CPM software.
- On the main screen of the UgCS-CPM, click on the “Payloads” button.
- From the available payload list, enable the “Laser Falcon 1 / 2 methane detector”.
- Press the “Save” button and confirm system reload.

Wait until the reload process is finished and the connection to the SkyHub is reestablished.

- On the main screen of the UgCS-CPM, click the “Start” button.
- From the drop-down widget list, select the “Laser Falcon 1 / 2 methane detector” and press the blue “plus” button.
- To access the configuration menu, press on the “three-dot” icon on the upper right corner of the widget and select “Settings”.

## 27.3 Laser Falcon 1 / 2 Methane Detector Configuration Parameters

| Parameter         | Default             | Min | Max   | Precision | Unit | Options                                                                           | Description                                                  |
|-------------------|---------------------|-----|-------|-----------|------|-----------------------------------------------------------------------------------|--------------------------------------------------------------|
| Min concentration | 0                   | 0   | 10000 | 1         | ppm  |                                                                                   | Minimal gas concentration to report in CPM                   |
| Max concentration | 1500                | 0   | 10000 | 1         | ppm  |                                                                                   | Maximal gas concentration to report CPM                      |
| Zero level        | 0                   | 0   | 10000 | 1         | ppm  |                                                                                   | Background compensation level                                |
| Frequency         | 2                   | 0   | 100   | 1         | Hz   |                                                                                   | Polling frequency to request data from the device            |
| Serial device     | Connector #4 (AMA3) |     |       |           |      | Connector #4 (AMA3),<br>Connector #5 (AMA4),<br>Connector USB1,<br>Connector USB2 | SkyHub connector number where sensor is connected            |
| Baud rate         | 19200               |     |       |           | bps  | 9600, 19200, 115200                                                               | Connection port baud rate, 19200 recommended by manufacturer |

|              |                   |     |     |   |  |                                               |                                                                                                                                                                                                                                               |
|--------------|-------------------|-----|-----|---|--|-----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Autopilot    | Default           |     |     |   |  | Default, DJI (autopilot), Mavlink (autopilot) | The source of coordinate data. With a default value it will use the first configured autopilot in the system. If user need to switch between two configured autopilots, he may set exactly [dji] or [mavlink] address to select the need one. |
| Data log dir | /data/skyhub_logs |     |     |   |  |                                               | Path on SkyHub storage where data is saved                                                                                                                                                                                                    |
| Payload Id   | 214               | 192 | 220 | 1 |  |                                               | Payload Id                                                                                                                                                                                                                                    |



## Laser Falcon Plus Methane Detector

**Note** The Sensor may be connected/disconnected only when the system is powered off.

- Attach the Universal Heavy Payload mount to the bottom of your drone.
- Attach the mounting cover to the back of the sensor.
- Mount the sensor on the Universal Heavy Payload mount.
- Connect the power cable to SkyHub power output port #7.
- Connect the Ethernet data transfer cable to SkyHub Ethernet port #10.

Power on the system.

- Establish either the drone link or auxiliary connection with the SkyHub in the UgCS-CPM software.
- On the main screen of the UgCS-CPM, click on the “Payloads” button.
- From the available payload list, enable the “Laser Falcon Plus methane detector”.
- Press the “Save” button and confirm system reload.

Wait until the reload process is finished and the connection to the SkyHub is reestablished.

- On the main screen of the UgCS-CPM, click the “Start” button.
- From the drop-down widget list, select the “Laser Falcon Plus methane detector” and press the blue “plus” button.
- To access the configuration menu, press on the “three-dot” icon on the upper right corner of the widget and select “Settings”.

### 28.1 Laser Falcon Plus Methane Detector Configuration Parameters

| Parameter       | Default | Min | Max | Precision | Unit | Options                                                                        | Description                                   |
|-----------------|---------|-----|-----|-----------|------|--------------------------------------------------------------------------------|-----------------------------------------------|
| Payload Id      | 213     | 192 | 220 | 1         |      |                                                                                | Payload Id                                    |
| Altitude source | Default |     |     |           |      | Lightware SF30D, Ainstein US-D1, Nanoradar NRA24, Mavlink (autopilot), Default | Altimeter that will be used for altitude data |

|                              |                   |   |        |   |   |                              |                                                                                                                                                                                                                                                                      |
|------------------------------|-------------------|---|--------|---|---|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Minimal starting amplitude   | 3                 | 0 | 1000   | 1 | m |                              | Minimal starting amplitude                                                                                                                                                                                                                                           |
| Amplitude threshold          | 0                 | 0 | 1000   | 1 | m |                              | Amplitude threshold                                                                                                                                                                                                                                                  |
| Calculation rate             | NORMAL            |   |        |   |   | FAST, NORMAL, SLOW           | Calculation rate.                                                                                                                                                                                                                                                    |
| Concentration threshold      | 0                 | 0 | 200000 | 1 | m |                              | Concentration threshold                                                                                                                                                                                                                                              |
| Correlation threshold        | 0                 | 0 | 200000 | 1 | m |                              | Correlation threshold                                                                                                                                                                                                                                                |
| Data log dir                 | /data/skyhub_logs |   |        |   |   |                              | Path on SkyHub storage where data is saved                                                                                                                                                                                                                           |
| Ethernet interface           |                   |   |        |   |   |                              | Ethernet interface to use                                                                                                                                                                                                                                            |
| Filtered concentration limit | 100000            | 0 | 200000 | 1 | m |                              | Filtered concentration limit                                                                                                                                                                                                                                         |
| IP address                   | 10.2.0.255        |   |        |   |   |                              | IP address of the device in the Ethernet network                                                                                                                                                                                                                     |
| IP address discovery mode    | 1                 |   |        |   |   | 0, 1                         | IP address discovery mode                                                                                                                                                                                                                                            |
| Leak limit                   | 0                 | 0 | 200000 | 1 | m |                              | Leak limit                                                                                                                                                                                                                                                           |
| SNR threshold                | 0                 | 0 | 1000   | 1 | m |                              | SNR threshold                                                                                                                                                                                                                                                        |
| Temperature mode             | NORMAL            |   |        |   |   | COLD, NORMAL, HOT            | Temperature mode                                                                                                                                                                                                                                                     |
| Action to run                | NONE              |   |        |   |   | NONE, REINITIALIZE, FIX_BASE | Action to run when logging started                                                                                                                                                                                                                                   |
| Green laser                  | 1                 |   |        |   |   | 0, 1, 2, 3, 4                | Vendor-defined value for green laser pointer mode. Current meaning 0 - Off 1 - On 2 - 0.5Hz 3 - 1Hz 4 - 2Hz Keep in mind that leaving the value 0 (off) is very dangerous since the main laser is invisible IR and there will be no indication that it is activated. |

## FluX Aero Methane Sniffer

**Note** The Sensor may be connected/disconnected only when the system is powered off.

- Attach the Universal Heavy Payload mount to the bottom of your drone.
- Attach the gas detector to the Universal Heavy Payload mount.
- Connect the data cable to the SkyHub Connector #4 (white).
- Connect the sampling cable to the gas detector through the port with the label “IN”.
- Attach the sampling arm through the holding clips on the side of the detector.
- Attach the sampling cable alongside the arm with the provided zip ties.

Power on the system.

- Establish either the drone link or auxiliary connection with the SkyHub in the UgCS-CPM software.
- On the main screen of the UgCS-CPM, click on the “Payloads” button.
- From the available payload list, enable the “FluX Aero Methane Sniffer”.
- Press the “Save” button and confirm system reload.

Wait until the reload process is finished and the connection to the SkyHub is reestablished.

- On the main screen of the UgCS-CPM, click the “Start” button.
- From the drop-down widget list, select the “FluX Aero Methane Sniffer” and press the blue “plus” button.
- To access the configuration menu, press on the “three-dot” icon on the upper right corner of the widget and select “Settings”.

### 29.1 FluX methane Gas Detector Configuration Parameters

| Parameter              | Default | Min | Max   | Precision | Unit | Options | Description                                          |
|------------------------|---------|-----|-------|-----------|------|---------|------------------------------------------------------|
| Max concentra-<br>tion | 1000    | 0   | 10000 | 1         | ppm  |         | Maximal gas concentration to report CPM              |
| Min concentra-<br>tion | 0       | 0   | 10000 | 1         | ppm  |         | Minimal gas concentration to report in CPM           |
| Analog output<br>Max   | 1000    | 0   | 10000 | 1         | ppm  |         | Maximal gas concentration to report to Analog output |

|                         |                     |     |       |      |     |                                                                                |                                                               |
|-------------------------|---------------------|-----|-------|------|-----|--------------------------------------------------------------------------------|---------------------------------------------------------------|
| Analog output Min       | 0                   | 0   | 10000 | 1    | ppm |                                                                                | Minimal gas concentration to report to Analog output          |
| Analog reference offset | 0                   | 0   | 10000 | 1    | m   |                                                                                | Analog reference offset                                       |
| Analog reference span   | 0.01                | 0.0 | 10000 | 0.01 | m   |                                                                                | Analog reference span                                         |
| Integration time Gas 1  | 10                  | 0   | 1000  | 1    | ms  |                                                                                | Integration time for gas 1, ms                                |
| Gas 1 offset            | 3                   | 0   | 10000 | 1    | ms  |                                                                                | Concentration gas 1 Offset                                    |
| Gas 1 span              | 1.1                 | 0.0 | 10000 | 0.01 | m   |                                                                                | Concentration gas 1 Span                                      |
| Integration time Gas 2  | 10                  | 0   | 1000  | 1    | ms  |                                                                                | Integration time for gas 2, ms                                |
| Gas 2 offset            | 1500                | 0   | 10000 | 1    | ms  |                                                                                | Concentration gas 2 Offset                                    |
| Gas 2 span              | 0.95                | 0.0 | 10000 | 0.01 | m   |                                                                                | Concentration gas 2 Span                                      |
| Diagnostic mode         | False               |     |       |      |     |                                                                                | Diagnostic mode turn on/off                                   |
| Baud rate               | 115200              |     |       |      | bps | 9600, 19200, 115200                                                            | Connection port baud rate, 115200 recommended by manufacturer |
| Mode                    | Single              |     |       |      |     | Single, Dual                                                                   | Switch sensor to single/double gases readings                 |
| Payload Id              | 192                 | 192 | 220   | 1    |     |                                                                                | Payload Id                                                    |
| Altitude source         | Default             |     |       |      |     | Lightware SF30D, Ainstein US-D1, Nanoradar NRA24, Mavlink (autopilot), Default | Altimeter that will be used for altitude data                 |
| Primary connector       | Connector #4 (AMA3) |     |       |      |     | Connector #1 (AMA1), Connector #2 (S0), Connector #4 (AMA3)                    | SkyHub connector                                              |



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## Medusa Radiometer

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When using a Medusa spectrometer in combination with the SkyHub, both systems need to be configured to send and receive data.

### 30.1 Prerequisites

#### 30.1.1 Software

- The Medusa spectrometer with a mDOS software version of V3.2 - Build 420 or higher.
- The SkyHub with a GNSS output software version of 4.1.2 and higher.
- A Universal driver and True Terrain Following license for the SkyHub.

#### 30.1.2 Hardware

- SkyHub (firmware version 4.2.1 and up)
- MDC-510 cable to have power and communication between the Medusa sensor and the SkyHub.
- Optionally for height measurements: a Lidar or Radar altimeter, compatible with the SkyHub.
- Optionally: For DJI M350 integration the MSB-302 mounting brackets are recommended.

### 30.2 Configuring the SkyHub

Enabling the output of GPS and altitude readings to the Medusa sensor, and accepting data coming from the Medusa sensor to the SkyHub can be done by configuring in CPM software.

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**Note** For users of SkyHub 4.2.1, configurations need to be made directly in the `skyhub.conf` file instead of using CPM software.

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#### 30.2.1 GPS and altitude

Modify the GNSS output in the All Settings section of CPM. Use Custom serial device `/dev/ttyNMEA`, baudrate 115200, prefix GN and include RMC GGA ZDA and RMZ messages. NMEA Log path should be set to `/tmp`.

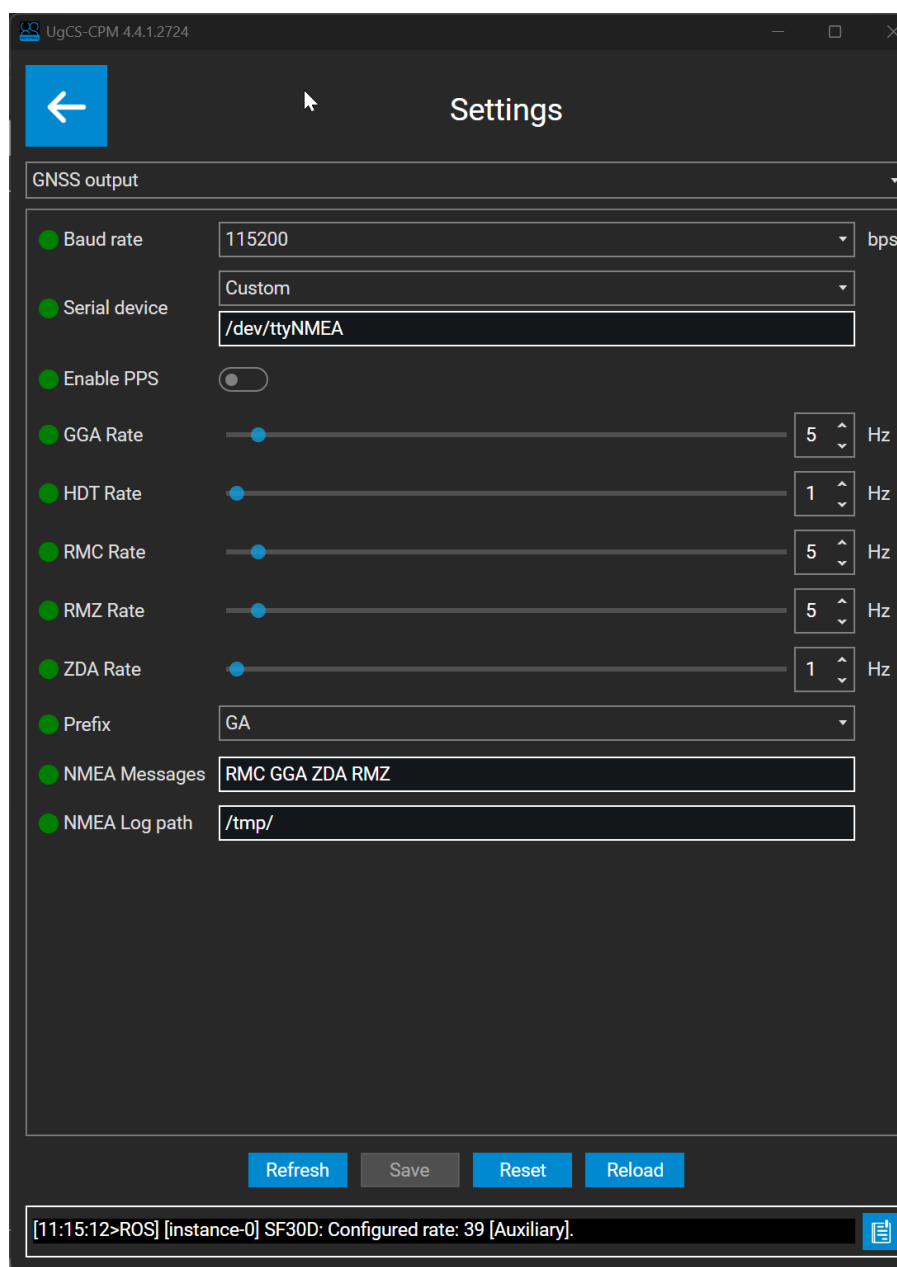


Figure 30.1. GNSS output configuration

### 30.2.2 Universal driver

The SkyHub offers the possibility to stream data from the Medusa sensor over the drones radiolink to the ground station. This can, for example, be displayed on the remote controller of the DJI M300/M350, and can be monitored in Custom Payload Monitor.

Universal driver configuration has to be done in CPM by adding Universal driver widget. Serial device has to be set to `/dev/ttyUNIVERSAL`, baudrate to 115200. Separator pattern for the values is `\r\n` and Value pattern is `(\d+)`.

UgCS-CPM 4.4.1.2724

## Settings

Universal driver [0]

Name: Universal driver [0]

Short name: Uni [0]

Measurement units: m

Min: 0

Max: 200

Serial device: Custom  
/dev/ttyUNIVERSAL

Payload Id: 192

UART baud rate: 115200 bps

Sensor name: MedusaGRS2

Separator pattern: \r\n

Value pattern: (\d+)

Refresh Save Reset Delete Reload

[11:15:32>ROS] Restart logs on system time update [Auxiliary]

Figure 30.2. Universal driver configuration

### 30.2.3 Allowing both services

The configuration below is for enabling both the input and output datastream. When only one stream is needed, the optional port splitting is not needed and the `SERIAL_DEVICE=/dev/ttyNMEA` and `SERIAL_DEVICE=/dev/ttyUNIVERSAL` should be replaced with `SERIAL_DEVICE=/dev/ttyAMA3`.

By default the SkyHub can also accept either a input or output stream on the same port. Therefore a program needs to be enabled that splits the input and output stream.

This is done by:

1. Copy the attached `medusa.service` file to the following path on the SkyHub: `/etc/systemd/system/medusa.service`
2. Copy the attached `createVirtualPorts.py` to the following path on the SkyHub: `/root/`

Then, while logged in on the SkyHub via ssh, execute the following commands:

```
# Reload daemon
sudo systemctl daemon-reload

# Enable the medusa service
sudo systemctl enable medusa.service

# Start the service
sudo systemctl start medusa.service
```

Finally, reboot the SkyHub and the configuration is complete.

### 30.2.4 Attachments

- medusa.service
- createVirtualPorts.py

## 30.3 Configuring the Medusa spectrometer

The spectrometer needs to be configured by using the mDOS interface on the data tab. Consult the mDOS manual for access to this page.

### 30.3.1 GPS and altimeter input

The input mode has to be configured as “NMEA strings”. Enable the NMEA contain RMZ messages, to enable parsing of altitude readings.

**RS232 port**

**Baud rate:** 115200

**Output Mode:** Count rate only

**Input Mode:** NMEA strings

**NMEA contains RMZ messages (height)** ☒

This option will listen for GGA, ZDA, RMC and RMZ NMEA messages on the serial port and parse these for a latitude and longitude. The positions will be translated to a JSON string and stored in the selected project.

**Show incoming data** 

Figure 30.3. GPS and altimeter input configuration

RMZ altitude and GPS readings will become visible on the mDOS dashboard page. The sensor readings look as following:

Sensor data updates

| Sensor    | Status                                                                                                                | Data                                                         | Info                                                                                |
|-----------|-----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Gamma-ray |  Collecting raw data, stabilizing... | Calibration in progres (0%)                                  |  |
| GPS       |  Running                             | Date: 28-3-2025 12h:57m 35s , Fix: fix                       |  |
| PTH       |  Running                             | Pressure: 1011.5 hpa, Temperature: 30.4 °C, Humidity: 40.2 % |  |
| Height    |  Running                             | Height: 0.49 m                                               |  |

 Pause

Figure 30.4. Sensor readings

30.3.2 Internal and external GPS

The Medusa sensor also has an internal GPS. When using the external SkyHub GPS, it is recommended to disable the internal GPS so that one GPS source is used. This can be done on the settings tab in mDOS.

The GPS can be inspected on the dashboard page by using the inspect datastream icon. GPS records sent from the SkyHub have the eID “GPS\_external” as shown in the screenshot below.

GPS info

Serial:

GPS\_0020

Type:

uBlox ZED-F9P

Show incoming data:



1

{ "eID": "GPS\_external", "vT": 1743162951544, "v": { "Lat": 53.21

2

{ "eID": "GPS\_external", "vT": 1743162951744, "v": { "Lat": 53.21

3

{ "eID": "GPS\_external", "vT": 1743162951945, "v": { "Lat": 53.21

4

{ "eID": "GPS\_external", "vT": 1743162952145, "v": { "Lat": 53.21

5

{ "eID": "GPS\_external", "vT": 1743162952345, "v": { "Lat": 53.21

6

{ "eID": "GPS\_external", "vT": 1743162952546, "v": { "Lat": 53.21

7

{ "eID": "GPS\_external", "vT": 1743162952746, "v": { "Lat": 53.21

8

{ "eID": "GPS\_external", "vT": 1743162952947, "v": { "Lat": 53.21

9

{ "eID": "GPS\_external", "vT": 1743162953147, "v": { "Lat": 53.21

10

Figure 30.5. GPS external

30.3.3 Medusa data output

When using the Universal driver capabilities of the SkyHub the detector needs to be configured to stream data to the SkyHub. This is done by selecting an output mode on the same data tab. Currently, the SkyHub supports Count rate only and Dose rate streaming.

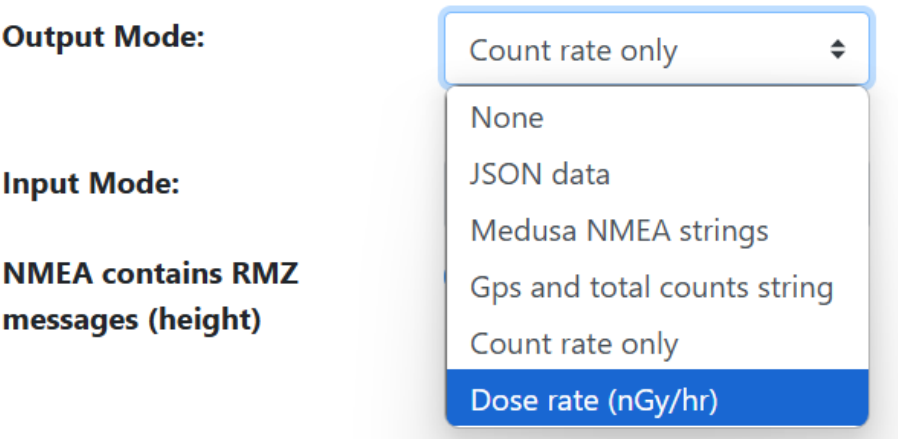


Figure 30.6. Data output configuration

**Note** For calculating a dose rate, the detector needs to be stabilized. Depending on the sensor size, this can take up to several minutes. The progress of stabilization can be seen on the dashboard tab of mDOS. While the sensor is not stabilized, no dose rate will be sent to the SkyHub.

| Sensor    | Status                                | Data                         | Info |
|-----------|---------------------------------------|------------------------------|------|
| Gamma-ray | ⚠ Collecting raw data, stabilizing... | Calibration in progres (36%) | ⓘ    |

Figure 30.7. Stabilization progress

When the above configuration is set the count rate or dose rate can be seen in Custom Payload Monitor (CPM) and on the remote controller of the DJI drone when using the UgCS Companion app.

Settings

Universal

Name Universal

Short Name UNI

Units Units

Min 0

Max 200

Payload Message ID 192

Apply

Reset

Figure 1. CPM view

Universal

Value 96

Units

Scale to Limits

Flip Vertically

Show History

Figure 2. CPM data

### 30.3.4 UgCS Companion

Below is a screenshot of the UgCS Companion app with a Medusa MS-100 sensor configured according to the above described protocol. In the bottom left corner the radar altimeter readings are displayed, and in the bottom right corner the count rate of the Medusa sensor.

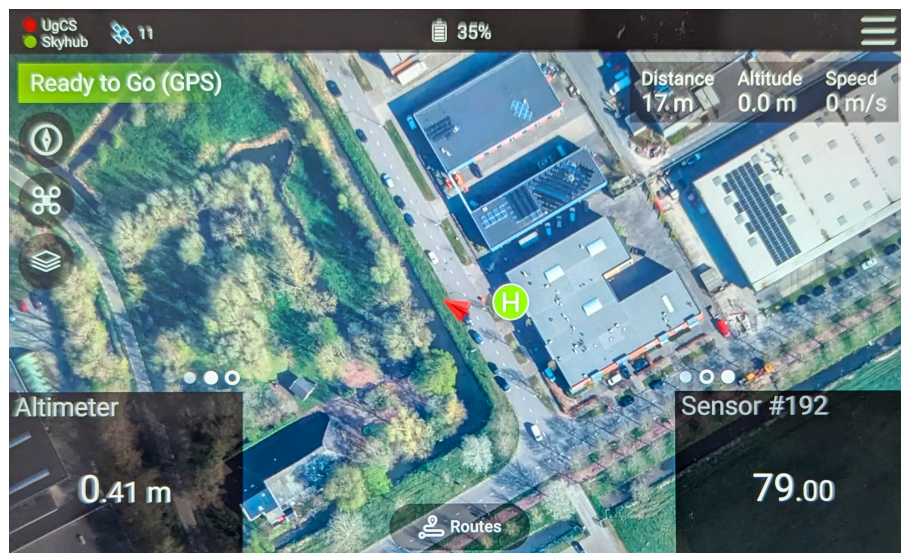


Figure 30.8. UgCS Companion app



## Nanoradar MR72 Radar

**Note** The Sensor may be connected/disconnected only when the system is powered off.

- Attach the radar to the mountings provided with the sensor.
- Install the sensor at the top of the drone.
- Connect the cable to SkyHub Connector #4 (white).
- If the SkyHub Connector #4 (white) is already in use by a different payload, connect the sensor to the SkyHub Connector #2 (green).

Power on the system.

- Establish either the drone link or auxiliary connection with the SkyHub in the UgCS-CPM software.
- On the main screen of the UgCS-CPM, click on the “Payloads” button.
- From the available payload list, enable the “Nanoradar MR72 radar”.
- Press the “Save” button and confirm system reload.

Wait until the reload process is finished and the connection to the SkyHub is reestablished.

- On the main screen of the UgCS-CPM, click the “Start” button.
- From the drop-down widget list, select the “Nanoradar MR72 radar” and press the blue “plus” button.
- To access the configuration menu, press on the “three-dot” icon on the upper right corner of the widget and select “Settings”.

### 31.1 Nanoradar MR72 Radar Configuration Parameters

| Parameter           | Default | Min | Max | Precision | Unit | Options        | Description                                                   |
|---------------------|---------|-----|-----|-----------|------|----------------|---------------------------------------------------------------|
| Ignore side sectors | False   |     |     |           |      |                | Ignore side sectors during distance to obstacle definition    |
| Payload Id          | 215     | 192 | 220 | 1         |      |                | Payload Id                                                    |
| Raw log             | False   |     |     |           |      |                | Enable RAW log                                                |
| UART baud rate      | 115200  |     |     |           | bps  | 115200, 230400 | Connection port baud rate, 115200 recommended by manufacturer |

|                    |                     |  |  |  |  |                                                                                  |                                                      |
|--------------------|---------------------|--|--|--|--|----------------------------------------------------------------------------------|------------------------------------------------------|
| UART serial device | Connector #4 (AMA3) |  |  |  |  | Connector #1 (AMA1), Connector #2 (S0), Connector #4 (AMA3), Connector #5 (AMA4) | SkyHub connector number where altimeter is connected |
|--------------------|---------------------|--|--|--|--|----------------------------------------------------------------------------------|------------------------------------------------------|

## GNSS Output

**Note** The receiver may be connected/disconnected only when the system is powered off.

GNSS Output sends messages containing RMC, ZDA, and GGA sentences in NMEA format to the defined address.

Coordinates, date, time, and other information for NMEA sentences are received from the drone (UAV).

Used for SenSys MagDrone R3, SenSys MagDrone R4, and other payloads requiring GNSS output.

- Attach your MagDrone or any other supported payload to the drone.
- Connect the GNSS data transfer cable to the SkyHub Connector #5 (blue).

Power on the system.

- Establish either the drone link or auxiliary connection with the SkyHub in the UgCS-CPM software.
- On the main screen of the UgCS-CPM, click on the “Payloads” button.
- From the available payload list, enable the “GNSS output”.
- Press the “Save” button and confirm system reload.

Wait until the reload process is finished and the connection to the SkyHub is reestablished.

- To access the configuration menu, on the main screen of the UgCS-CPM, click the “Settings” button.
- From the drop-down widget list, select the “GNSS output”.

### 32.1 GNSS Output Configuration Parameters

| Parameter     | Default             | Min | Max | Precision | Unit | Options                                  | Description                                       |
|---------------|---------------------|-----|-----|-----------|------|------------------------------------------|---------------------------------------------------|
| Baud rate     | 57600               |     |     |           | bps  | 57600, 115200, 230400                    | Set output port baud rate                         |
| Serial device | Connector #5 (AMA4) |     |     |           |      | Connector #4 (AMA3), Connector #5 (AMA4) | SkyHub connector number where device is connected |
| Enable PPS    | False               |     |     |           |      |                                          | Enable or disable PPS echo mode                   |
| GGA Rate      | 5                   | 0   | 100 | 1         | Hz   |                                          | Rate of GGA messages update rate                  |

|               |                |   |     |   |    |            |                                                                                                                      |
|---------------|----------------|---|-----|---|----|------------|----------------------------------------------------------------------------------------------------------------------|
| HDT Rate      | 1              | 0 | 100 | 1 | Hz |            | Rate of HDT messages update rate                                                                                     |
| RMC Rate      | 5              | 0 | 100 | 1 | Hz |            | Rate of RMC messages update rate                                                                                     |
| RMZ Rate      | 5              | 0 | 100 | 1 | Hz |            | Rate of RMZ messages update rate                                                                                     |
| ZDA Rate      | 1              | 0 | 100 | 1 | Hz |            | Rate of ZDA messages update rate                                                                                     |
| Prefix        | GN             |   |     |   |    | GN, GP, GA | Two letters prefix for generated messages ID: \$<PREFIX><MESSAGE>                                                    |
| NMEA Messages | RMC GGA<br>ZDA |   |     |   |    |            | NMEA messages list to send into port. List entries are space-separated. Supported messages are: RMC GGA ZDA RMZ HDT. |
| NMEA Log path |                |   |     |   |    |            | Write NMEA messages into text file in the specified directory                                                        |

## GNSS Receiver

**Note** The receiver may be connected/disconnected only when the system is powered off.

GNSS plugin supports GPS receivers with NMEA output data and connection through USB or UART.

GNSS plugin supports parsing for ZDA and GGA sentences of NMEA format.

- Attach the receiver to the drone.
- Additional receiver configuration might be necessary depending on the model you choose.
- Connect the data transfer cable to the SkyHub Connector #4 (white).

Power on the system.

- Establish either the drone link or auxiliary connection with the SkyHub in the UgCS-CPM software.
- On the main screen of the UgCS-CPM, click on the “Payloads” button.
- From the available payload list, enable the “GNSS receiver”.
- Press the “Save” button and confirm system reload.

Wait until the reload process is finished and the connection to the SkyHub is reestablished.

- On the main screen of the UgCS-CPM, click the “Start” button.
- From the drop-down widget list, select the “GNSS receiver” and press the blue “plus” button.
- To access the configuration menu, press on the “three-dot” icon on the upper right corner of the widget and select “Settings”.

### 33.1 GNSS Receiver Configuration Parameters

| Parameter     | Default      | Min | Max | Precision | Unit | Options        | Description                                                             |
|---------------|--------------|-----|-----|-----------|------|----------------|-------------------------------------------------------------------------|
| Baud rate     | 115200       |     |     |           | bps  | 115200, 230400 | Set output port baud rate                                               |
| Date format   | yyyy/mm/dd   |     |     |           |      |                | Date string format to write into log                                    |
| Time format   | hh:mm:ss.zzz |     |     |           |      |                | Time string format to write into log                                    |
| NMEA Messages | GGA ZDA      |     |     |           |      |                | NMEA messages list to send into port. List entries are space-separated. |

|               |                        |     |     |   |  |                                                      |                                                                        |
|---------------|------------------------|-----|-----|---|--|------------------------------------------------------|------------------------------------------------------------------------|
| Prefix        | GN                     |     |     |   |  | GN, GP,<br>GA                                        | Two letters prefix for<br>incoming messages ID:<br>\$<PREFIX><MESSAGE> |
| Payload Id    | 192                    | 192 | 220 | 1 |  |                                                      | Payload Id                                                             |
| Serial device | Connector #4<br>(AMA3) |     |     |   |  | Connector<br>#4<br>(AMA3),<br>Connector<br>#5 (AMA4) | SkyHub connector number<br>where device is connected                   |

## Universal Driver

Universal driver can be used to connect and display data from non-integrated (custom-developed) payloads and sensors.

**Note** Never connect any payload when the system is powered on.

- Attach the custom sensor to the drone.
- Connect the data transfer cable to the SkyHub Connector #4 (white) or Connector #5 (blue).
- Connect the power cable to the SkyHub power output port #7 (if necessary).

Power on the system.

- Establish either the drone link or auxiliary connection with the SkyHub in the UgCS-CPM software.
- On the main screen of the UgCS-CPM, click on the “Payloads” button.
- From the available payload list, enable the “Universal driver”.
- Press the “Save” button and confirm system reload.

Wait until the reload process is finished and the connection to the SkyHub is reestablished.

- On the main screen of the UgCS-CPM, click the “Start” button.
- From the drop-down widget list, select the “Universal driver” and press the blue “plus” button.
- To access the configuration menu, press on the “three-dot” icon on the upper right corner of the widget and select “Settings”.

### 34.1 Universal Driver Configuration Parameters

| Parameter      | Default             | Min | Max | Precision | Unit | Options                                                  | Description                                                   |
|----------------|---------------------|-----|-----|-----------|------|----------------------------------------------------------|---------------------------------------------------------------|
| Serial device  | Connector #4 (AMA3) |     |     |           |      | Connector #4 (AMA3),<br>Connector #5 (AMA4)              | SkyHub connector number where device is connected             |
| Payload Id     | 192                 | 192 | 220 | 1         |      |                                                          | Payload Id                                                    |
| UART baud rate | 115200              |     |     |           | bps  | 9600, 14400, 19200, 38400, 57600, 115200, 128000, 256000 | Connection port baud rate, 115200 recommended by manufacturer |
| Sensor name    | MySensor            |     |     |           |      |                                                          | Log file suffix                                               |

|                   |      |  |  |  |  |  |                                   |
|-------------------|------|--|--|--|--|--|-----------------------------------|
| Separator pattern | \r\n |  |  |  |  |  | How to split records              |
| Value pattern     | \d+  |  |  |  |  |  | How to split values in the record |



## Wind Sensor (FTT)

**Note** The Sensor may be connected/disconnected only when the system is powered off.

- Attach the pole holding the sensor to the drone using two mounting places.
- Tighten the first mount (at the bottom of the pole) to the leg of the drone.
- Tighten the second mount (at the middle of the pole) to the top of the drone.
- Connect the data cable to SkyHub Connector #4 (white).

Power on the system.

- Establish either the drone link or auxiliary connection with the SkyHub in the UgCS-CPM software.
- On the main screen of the UgCS-CPM, click on the “Payloads” button.
- From the available payload list, enable the “Wind sensor (FTT)”.
- Press the “Save” button and confirm system reload.

Wait until the reload process is finished and the connection to the SkyHub is reestablished.

- On the main screen of the UgCS-CPM, click the “Start” button.
- From the drop-down widget list, select the “Wind sensor (FTT)” and press the blue “plus” button.
- To access the configuration menu, press on the “three-dot” icon on the upper right corner of the widget and select “Settings”.

### 35.1 Wind Sensor (FTT) Configuration Parameters

| Parameter      | Default | Min | Max   | Precision | Unit | Options | Description                                  |
|----------------|---------|-----|-------|-----------|------|---------|----------------------------------------------|
| Min wind speed | 0.0     | 0.0 | 100.0 | 0.01      | mps  |         | Minimal wind speed limit                     |
| Max wind speed | 50.0    | 0.0 | 50.0  | 0.01      | mps  |         | Maximal wind speed limit                     |
| Raw log        | False   |     |       |           |      |         | Write raw data byte stream into separate log |

|               |                        |     |     |   |     |                                                                            |                                                                       |
|---------------|------------------------|-----|-----|---|-----|----------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Serial device | Connector #4<br>(AMA3) |     |     |   |     | Connector #2<br>(S0),<br>Connector #4<br>(AMA3),<br>Connector #5<br>(AMA4) | SkyHub connector<br>number where<br>altimeter is<br>connected         |
| Baud rate     | 38400                  |     |     |   | bps | 19200, 38400,<br>57600                                                     | Connection port<br>baud rate, 38400<br>recommended by<br>manufacturer |
| Payload Id    | 217                    | 192 | 220 | 1 |     |                                                                            | Payload Id                                                            |

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## Ebinger VEMOS AIR

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**Note** The Sensor may be connected/disconnected only when the system is powered off.

---

- Attach the Universal Heavy Payload mount to the bottom of your drone.
- Attach the safety anchor to the Universal Heavy Payload mount.
- Attach the SkyHub to the drone.
- Attach the controller on the legs of the drone (front side).
- Connect the data cable from the controller to the SkyHub Connector #4 (white).
- Attach the altimeter (mounted on the rod) to the front leg of the drone.
- Connect the altimeter to the SkyHub Connector #1 (yellow).
- Connect the coil to the controller.
- Connect the coil's ring to the safety anchor.

Power on the system.

- Establish either the drone link or auxiliary connection with the SkyHub in the UgCS-CPM software.
- On the main screen of the UgCS-CPM, click on the “Payloads” button.
- From the available payload list, enable the “Ebinger Vemos”.
- Press the “Save” button and confirm system reload.

Wait until the reload process is finished and the connection to the SkyHub is reestablished.

- On the main screen of the UgCS-CPM, click the “Start” button.
- From the drop-down widget list, select the “Ebinger Vemos” and press the blue “plus” button.
- To access the configuration menu, press on the “three-dot” icon on the upper right corner of the widget and select “Settings”.

### 36.1 Ebinger VEMOS AIR Configuration Parameters

| Parameter | Default | Min | Max | Precision | Unit | Options       | Description                        |
|-----------|---------|-----|-----|-----------|------|---------------|------------------------------------|
| Baud rate | 38400   |     |     |           | bps  | 38400, 115200 | 38400 is recommended by the vendor |

| Serial device | Connector #4<br>(AMA3) |     |     |   |  | Connector #4<br>(AMA3),<br>Connector #5<br>(AMA4) | SkyHub connector<br>number where<br>sensor is connected |
|---------------|------------------------|-----|-----|---|--|---------------------------------------------------|---------------------------------------------------------|
| Payload Id    | 192                    | 192 | 220 | 1 |  |                                                   | Payload Id                                              |

## Geolux LX-80-AB

**Note** The Sensor may be connected/disconnected only when the system is powered off.

- Attach the Universal Heavy Payload mount to the bottom of your drone.
- Attach the sensor to the Universal Heavy Payload mount.
- Connect the data cable to the SkyHub Connector #4.
- Connect the power cable to the SkyHub power in connector #6.

Power on the system.

- Establish either the drone link or auxiliary connection with the SkyHub in the UgCS-CPM software.
- On the main screen of the UgCS-CPM, click on the “Payloads” button.
- From the available payload list, enable the “Geolux LX-80-AB”.
- Press the “Save” button and confirm system reload.

Wait until the reload process is finished and the connection to the SkyHub is reestablished.

- On the main screen of the UgCS-CPM, click the “Start” button.
- From the drop-down widget list, select the “Geolux LX-80-AB” and press the blue “plus” button.
- To access the configuration menu, press on the “three-dot” icon on the upper right corner of the widget and select “Settings”.

### 37.1 Geolux LX-80-AB Configuration Parameters

| Parameter     | Default           | Min | Max | Precision | Unit | Options                               | Description                                       |
|---------------|-------------------|-----|-----|-----------|------|---------------------------------------|---------------------------------------------------|
| Can interface | Disable           |     |     |           |      | Disable, can0, can1, can2, can3, can4 | Can interface                                     |
| Data log dir  | /data/skyhub_logs |     |     |           |      |                                       | Path on SkyHub storage where data is saved        |
| Payload Id    | 192               | 192 | 220 | 1         |      |                                       | Payload Id                                        |
| Serial device | Connector #4      |     |     |           |      | Connector #4, Connector #5            | SkyHub connector number where sensor is connected |

|                 |         |  |  |  |     |                                                                                |                                                                |
|-----------------|---------|--|--|--|-----|--------------------------------------------------------------------------------|----------------------------------------------------------------|
| Baud rate       | 115200  |  |  |  | bps | 9600, 19200, 115200                                                            | Connection port baud rate, 115200 is recommended by the vendor |
| Altitude source | Default |  |  |  |     | Lightware SF30D, Ainstein US-D1, Nanoradar NRA24, Mavlink (autopilot), Default | Altimeter that will be used for altitude data                  |

## Geolux RSS-2-AB

**Note** The Sensor may be connected/disconnected only when the system is powered off.

- Attach the Universal Heavy Payload mount to the bottom of your drone.
- Attach the sensor to the Universal Heavy Payload mount.
- Connect the data cable to the SkyHub Connector #4.
- Connect the power cable to the SkyHub power in connector #6.

Power on the system.

- Establish either the drone link or auxiliary connection with the SkyHub in the UgCS-CPM software.
- On the main screen of the UgCS-CPM, click on the “Payloads” button.
- From the available payload list, enable the “Geolux RSS-2-AB”.
- Press the “Save” button and confirm system reload.

Wait until the reload process is finished and the connection to the SkyHub is reestablished.

- On the main screen of the UgCS-CPM, click the “Start” button.
- From the drop-down widget list, select the “Geolux RSS-2-AB” and press the blue “plus” button.
- To access the configuration menu, press on the “three-dot” icon on the upper right corner of the widget and select “Settings”.

### 38.1 Geolux RSS-2-AB Configuration Parameters

| Parameter       | Default | Min | Max | Precision | Unit | Options                                                                        | Description                                              |
|-----------------|---------|-----|-----|-----------|------|--------------------------------------------------------------------------------|----------------------------------------------------------|
| Altitude source | Default |     |     |           |      | Lightware SF30D, Einstein US-D1, Nanoradar NRA24, Mavlink (autopilot), Default | Altimeter that will be used for altitude data            |
| Baud rate       | 9600    |     |     |           | bps  | 9600, 19200                                                                    | Connection port baud rate, 9600 is recommended by vendor |

|               |                   |     |     |   |  |                               |                                                   |
|---------------|-------------------|-----|-----|---|--|-------------------------------|---------------------------------------------------|
| Can interface |                   |     |     |   |  |                               | Can interface                                     |
| Data log dir  | /data/skyhub_logs |     |     |   |  |                               | Path on SkyHub storage where data is saved        |
| Payload Id    | 192               | 192 | 220 | 1 |  |                               | Payload Id                                        |
| Serial device | Connector #4      |     |     |   |  | Connector #4,<br>Connector #5 | SkyHub connector number where sensor is connected |



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## Drop Messenger

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**Note** The water sampler may be connected/disconnected only when the system is powered off.

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- Attach the Universal Heavy Payload mount to the bottom of your drone.
- Attach the water sampler to the Universal Heavy Payload mount.
- Connect the power cable to the SkyHub power output port #7.

Power on the system.

- Establish either the drone link or auxiliary connection with the SkyHub in the UgCS-CPM software.
- On the main screen of the UgCS-CPM, click on the “Payloads” button.
- From the available payload list, enable the “Drop messenger”.
- Press the “Save” button and confirm system reload.

Wait until the reload process is finished and the connection to the SkyHub is reestablished.

- To access the configuration menu, on the main screen of the UgCS-CPM, click the “Settings” button.
- From the drop-down widget list, select the “Drop messenger”.

### 39.1 Drop Messenger Configuration Parameters

| Parameter      | Default | Min | Max | Precision | Unit | Description                                                |
|----------------|---------|-----|-----|-----------|------|------------------------------------------------------------|
| Control pin    | 24      | 0   | 36  | 1         |      | The number of RPI GPIO pin used to control the payload.    |
| Initial state  | True    |     |     |           |      | The initial level of control pin. True = high, False = low |
| Power cycle, s | 0.5     | 0.1 | 5   | 0.1       | s    | The duration of power flips on release event (seconds).    |



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## True Terrain Following

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### 40.1 Hybrid route

In a hybrid route, it is possible to combine waypoints and segments with different altitude modes - AGL/AMSL for altitude navigation using GPS and Rangefinder for altitude navigation using an altimeter. AGL/AMSL altitude can be used in parts of the route where it is necessary to fly over obstacles or very uneven terrain, where flight using an altimeter would cause a lot of ascending and descending. Rangefinder altitude is used for TTF segments where it is necessary to maintain altitude using an altimeter for data collection.

---

**Note** It is recommended to set AGL/AMSL altitude at least 5 m above the digital elevation map.

---

|                                                                                                            |
|------------------------------------------------------------------------------------------------------------|
| <p><b>Warning Attention:</b> due to elevation model error, real AGL altitude may differ from expected.</p> |
|------------------------------------------------------------------------------------------------------------|

Use additional waypoints to create a smooth transition from AGL/AMSL to Rangefinder altitudes. For accurate altitude transition, it is recommended to set the turn type to Stop & turn.

Example:

- Waypoint#1 - AGL 20m;
- Waypoint#2 - AGL 5m;
- Waypoint#3 - Rangefinder 3m;
- Waypoint#4 - Rangefinder 1m.

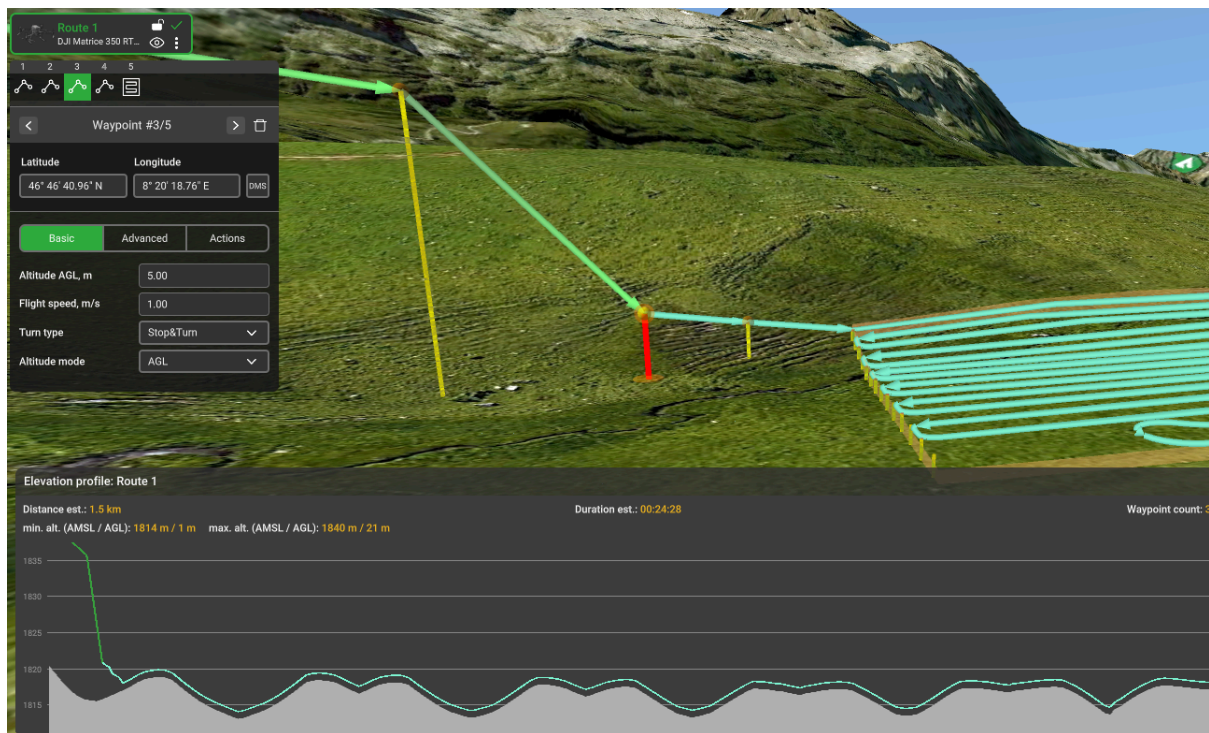


Figure 40.1. Transition from AGL to Rangefinder mode

**Note** For the mission to be uploaded to the SkyHub, at least one waypoint or segment of your route must be in the **Rangefinder** mode. Otherwise, the mission will be uploaded to the DJI autopilot.

## 40.2 Rangefinder route

If flight specifics require that flight altitude is maintained using an altimeter during the entire route from the start position, Rangefinder altitude can be used on all route segments.

The drone will take Rangefinder altitude using the altimeter immediately after Terrain Following activation and move to the first position on the route while maintaining this altitude.

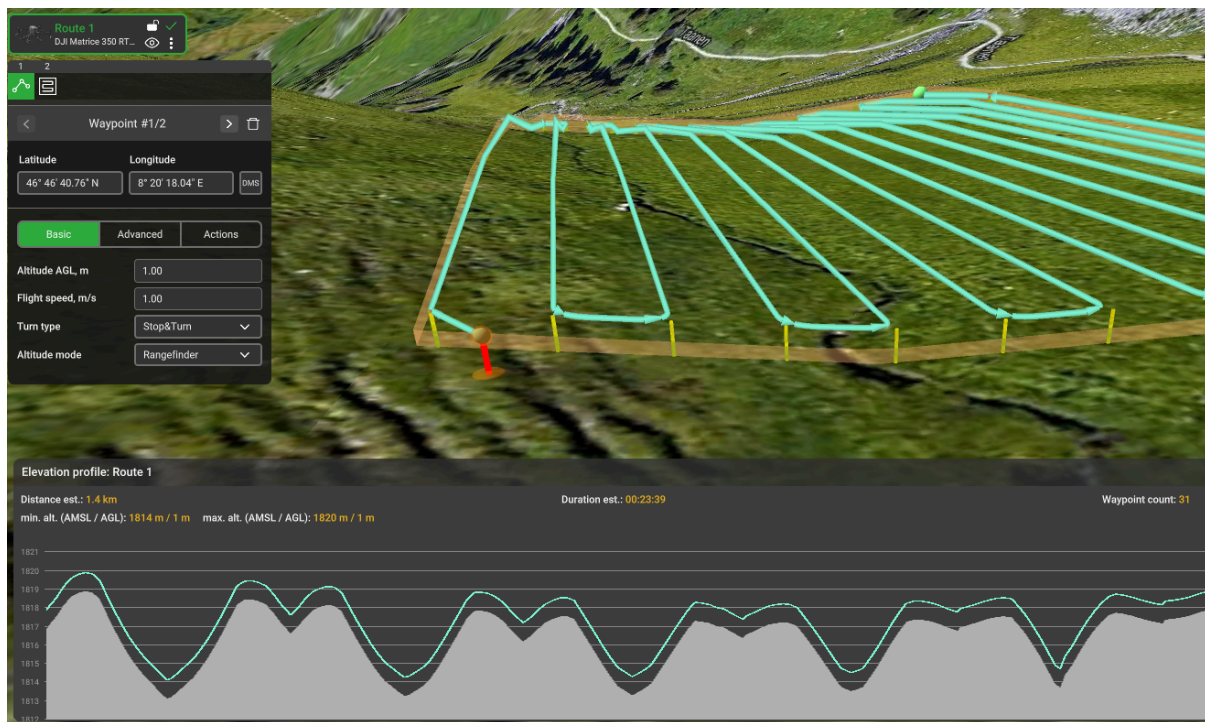


Figure 40.2. Route with all segments with Rangefinder altitude

## 40.3 Flight process step by step

1. Connect your PC to the Wi-Fi network. Start the UgCS flight planning software on your PC and plan a mission for the drone.
2. Ensure that SkyHub and all payload devices are properly connected to the drone.
3. Turn on the DJI Remote Controller and connect it to the same Wi-Fi network as the PC.

---

**Note** If you are using the **DJI RC Plus controller**, make sure that the switch is in the N-mode.

If you are using the **DJI Smartcontroller**, make sure that the switch is in the P-mode.

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4. Run the UgCS Companion mobile application on your remote controller. Wait for the application to show the main window and connect to UgCS on your PC.
5. Ensure that the drone with a correct profile appears in the UgCS on the PC and drone telemetry (battery, uplink, downlink, satellites) are present.
6. Ensure that only the used payloads are enabled in the UgCS-CPM Payloads section. Each payload should be properly configured, following the sensor setup guide.

---

**Note** Before the flight, you can erase old data files from the SkyHub if they are no longer needed (see [Log Files Management](#) for details).

---

7. Check if the UgCS, Drone, and SkyHub indicators are green. Add the Terrain Following widget and other widgets related to connected payloads by clicking the “plus” button.

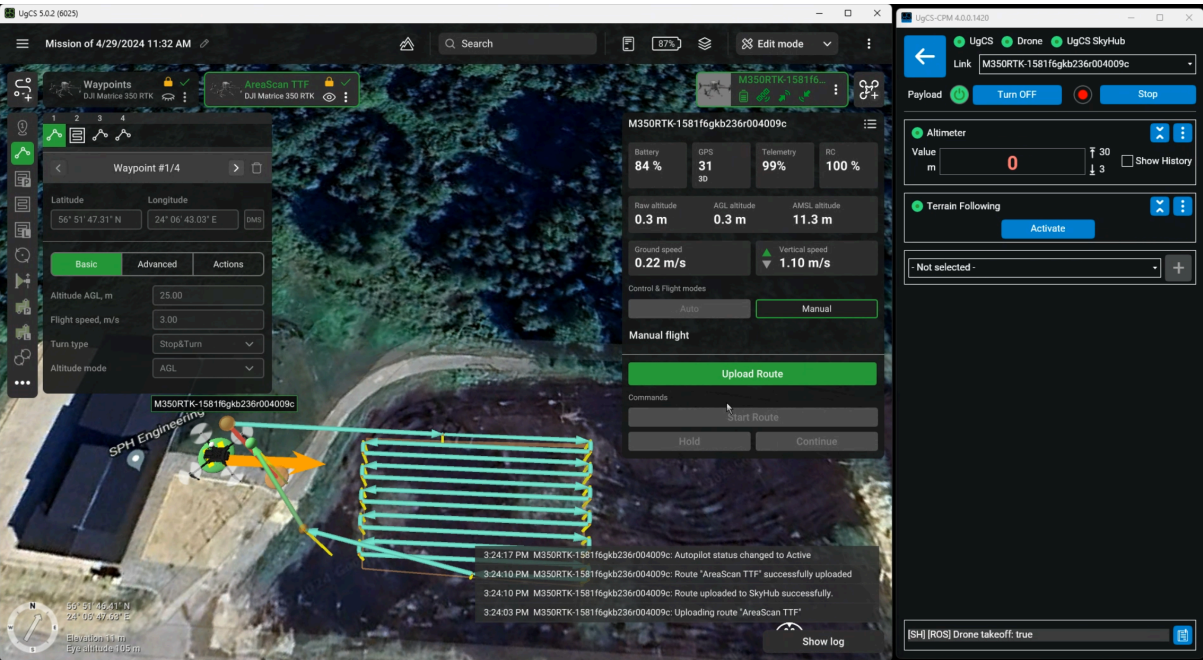


Figure 40.3. UgCS and UgCS-CPM application open side-by-side

8. Check the Altimeter widget, it should displays the altimeter data.

**Note** While stationary, radar altimeter will display the random readings. This is expected behaviour, since it must be in a motion to get the true readings.

9. Check the altitude Min/Max limits in altimeter widget settings.

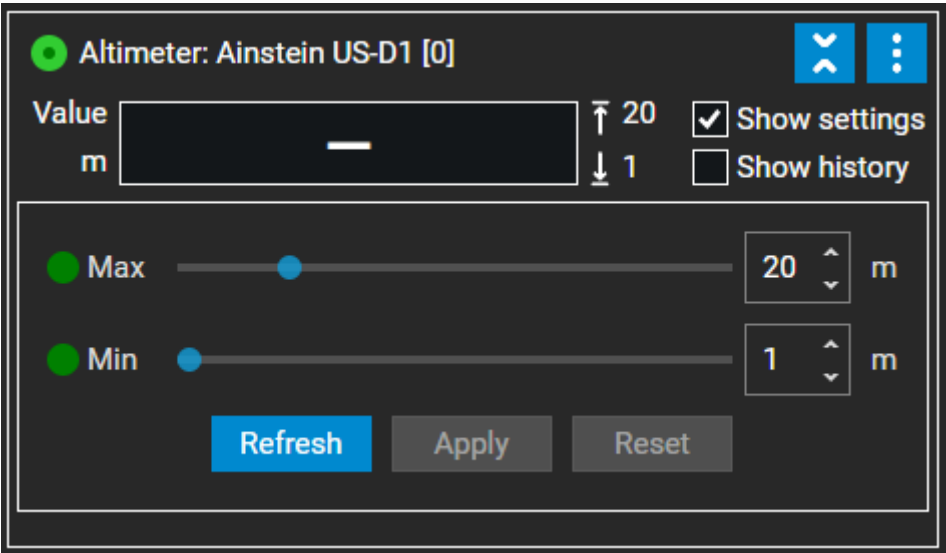


Figure 40.4. Altimeter Min/Max value setup

**Note** If during the flight, altimeter will receive the readings that are below the minimum or above the maximum values you set, **failsafe action** will be triggered.

10. Check and configure Safe altitude in True Terrain Following widget settings.

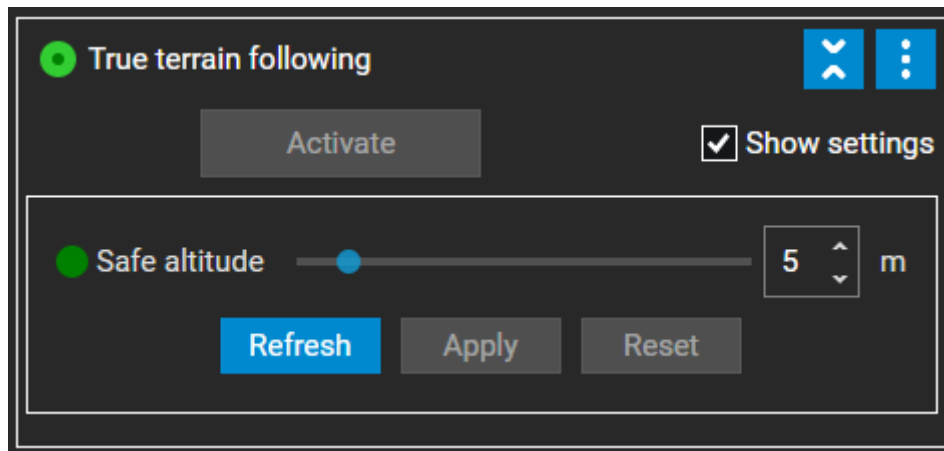


Figure 40.5. Altimeter safe altitude setup

**Note** During the failsafe, the drone will ascend to the **safe altitude** value you selected and execute a chosen fail-safe action.

**Warning** Failsafe may be triggered:

- During TTF activation. If at the moment, the drone is higher or lower than min/max altitude.
- If the altitude readings during the flight are below min. altitude (the drone is too close to the ground or obstacle).
- If the altitude readings during the flight go above the max. altitude (sudden elevation changes).
- If the SkyHub stops receiving the data from the altimeter.

11. Create / verify route in UgCS. All route altitudes must be in altimeter min / max range limits.

**Warning Attention:** For Hybrid route AGL and AMSL waypoints are navigated using GPS. SkyHub altitude safety check will trigger failsafe if drone flying to AGL or AMSL waypoint will go below the configured altimeter minimum value **MIN\_ALTITUDE\_M + 2m**.



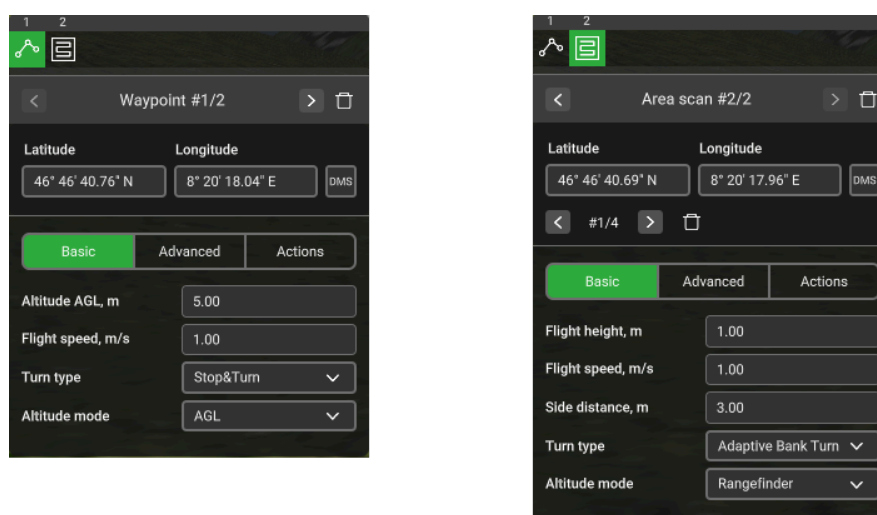


Figure 40.6. First waypoint / Area scan segment with Rangefinder altitude configured

**Warning Attention:** It is strongly recommended not to set **Target Altitude** more than **10 meters** for the laser altimeter **above water**

**Attention:** AGL and AMSL waypoints are navigated using GPS. SkyHub altitude safety check will trigger failsafe if drone flying to AGL or AMSL waypoint will go below **Altimeter Min value + 2m**.

12. Upload the route to the drone using **Upload Route** command in UgCS.
13. **Perform manual takeoff** using the DJI Remote Controller and rise up to the appropriate altitude (see limits from step 8).
14. Manually fly the drone close to route start position.
15. There are three ways how to activate True Terrain following flight: Press **Start** in UgCS Companion application

Move the flight mode switch from N-Mode then to F-mode

Press the **Activate** button in the Terrain Following widget

16. You may interrupt the flight by moving the flight mode switch from F-Mode then to N-mode, or by pressing the **Pause** button in UgCS Companion application or in True Terrain Following widget (UgCS-CPM).

The flight can be resumed by moving the flight mode switch to N-mode then to F-mode, or by pressing the **Resume** button in UgCS Companion application or in True Terrain Following widget (UgCS-CPM).

During pause you may manually control the drone, for example fly around an obstacle. In this case the drone returns to the nearest not completed point on the route by the shortest way after resuming.

**Warning Attention:** the flight mode on the DJI Remote Controller must be obligatory switched back to **N-mode** before manually control. Otherwise, the drone returns to an unexpected resuming point.

**Note** If the DJI M400 stops mid-flight during a TTF route and cannot be controlled manually using the RC, the following actions can be taken to regain manual control:

- Press the **Pause** button on the DJI RC Plus 2 (yellow button with the pause symbol)



- Press the **Manual Mode** button in UgCS
- 

17. If the drone descends below the minimum allowed altitude or ascends above the maximum allowed altitude (see step 8), it stops, then climbs to safe altitude. Safe altitude can be configured in True Terrain Following widget settings. You may manually correct drone position and resume the flight according to recommendations at step 14.
18. After the mission has been completed the drone stops at the last waypoint then climbs to increase its altitude to value configured in True Terrain Following widget settings.
19. Switch the flight mode to N-Mode to take control, then return the drone to the desired landing position, and land the drone manually.
20. Download the flight results (see [Log Files Management](#)).



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## Grasshopper Mode

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### 41.1 Prerequisites

- UgCS desktop version 5.17.0 or newer.
- SkyHub/UgCS-CPM version 4.4.3 or newer.
- UgCS Companion 1.11.1 or newer.

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**Note** Starting from UgCS-CPM version 4.4.3, standalone grasshopper widget and configuration is removed from the CPM software.

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### 41.2 Hop action



Figure 41.1. Hop action icon within UgCS software

The Hop action is designed to streamline the creation of the Grasshopper workflow.

The Grasshopper workflow allows the UAV to perform precise, point-based descents to a predefined height for data collection before returning to its flight altitude. This mode is particularly useful for measurements requiring direct proximity to the surface, such as water sampling, echo sounding, or specific geophysical readings.

When applied to the appropriate segment, it creates a series of waypoints at which the drone descends, waits (optional) and ascends back to the general flight altitude.

---

**Note** Hop action is available for the **Area scan**, **Corridor Mapping**, **LiDAR Corridor** and **Waypoint segments**. This action can only be used in combination with the SkyHub on-board computer; therefore, the segment altitude mode should be set to **Rangefinder**

---

### 41.3 Mission planning

1. Start with the **Area scan tool**, and mark the boundaries of the area you wish to scan using the grasshopper

mode.

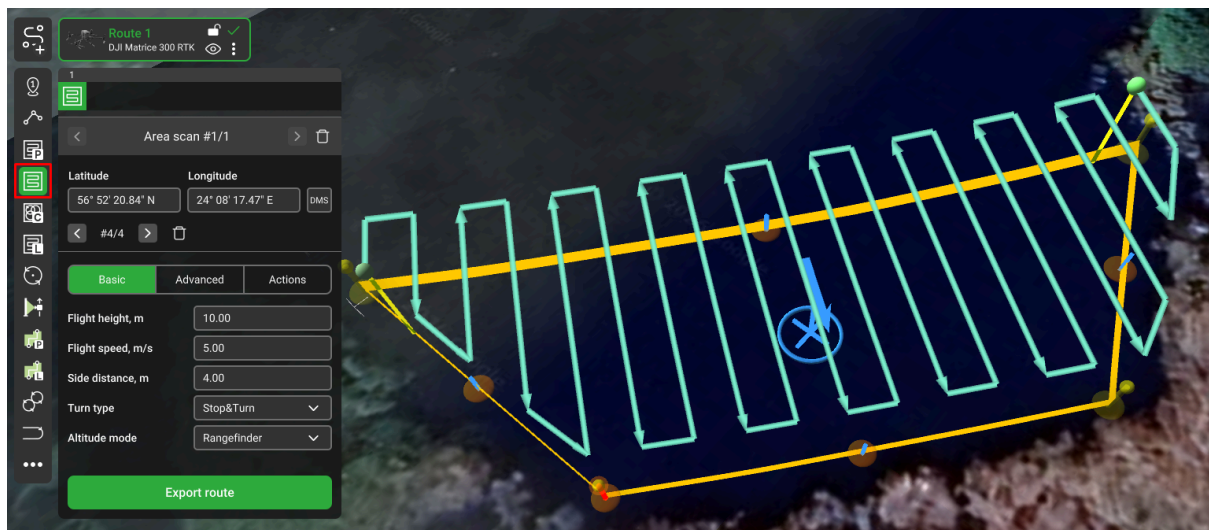


Figure 41.2. Area scan action within UgCS software

2. When the area is marked, click on the **Actions** and add the **Hop** action.

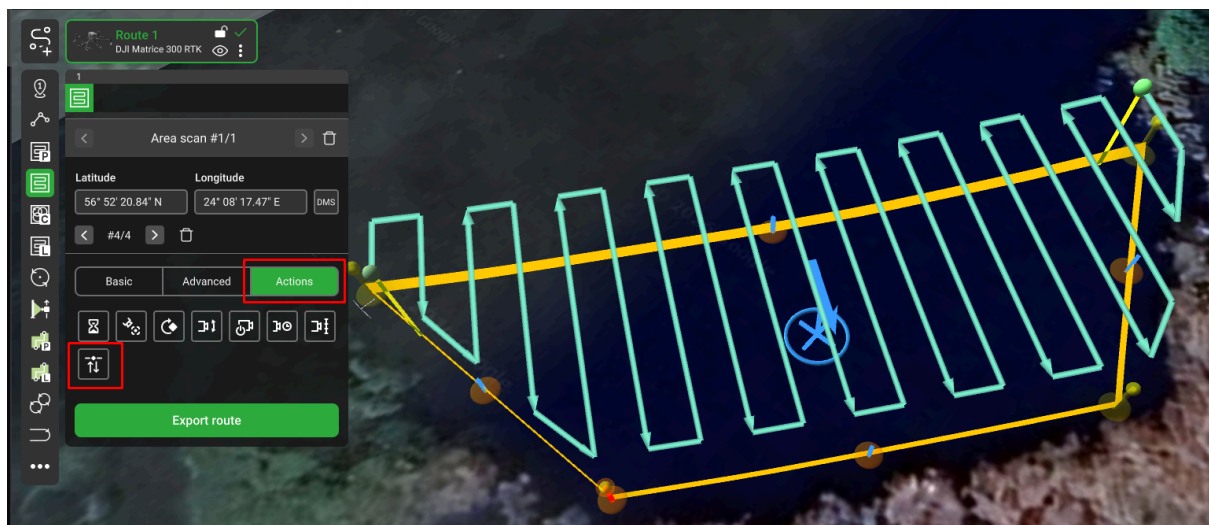
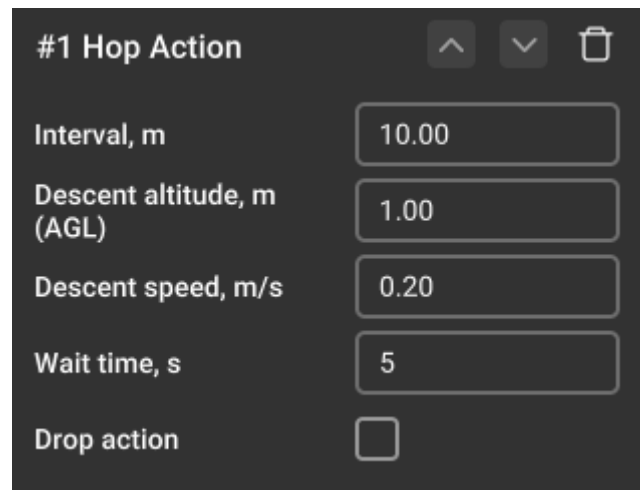


Figure 41.3. Hop action select from the Actions tab

The Hop action has the following parameters:



|                           |                          |
|---------------------------|--------------------------|
| #1 Hop Action             |                          |
| Interval, m               | 10.00                    |
| Descent altitude, m (AGL) | 1.00                     |
| Descent speed, m/s        | 0.20                     |
| Wait time, s              | 5                        |
| Drop action               | <input type="checkbox"/> |

Figure 41.4. Hop action parameters within the UgCS software

- **Interval** - adds waypoints at the specified distance. If the interval isn't set and additional waypoints are not generated, the action is applied only to the turning waypoints.
- **Descent altitude** - the descent altitude over surface.
- **Descent speed** - speed at which the drone descends.
- **Wait time** - the pause time at the descent position.
- **Drop action** - adds a drop action at the descent position for the supported payloads. If the Drop action is enabled, it will be performed in the middle of the specified "Wait Time". The timer does not pause for the duration of the Drop action.

**Warning** By default, descent speed is taken from the SkyHub configuration and cannot be higher than 1m/s. If necessary, descent speed can be adjusted only to the lower value.

3. Grasshopper route is ready.

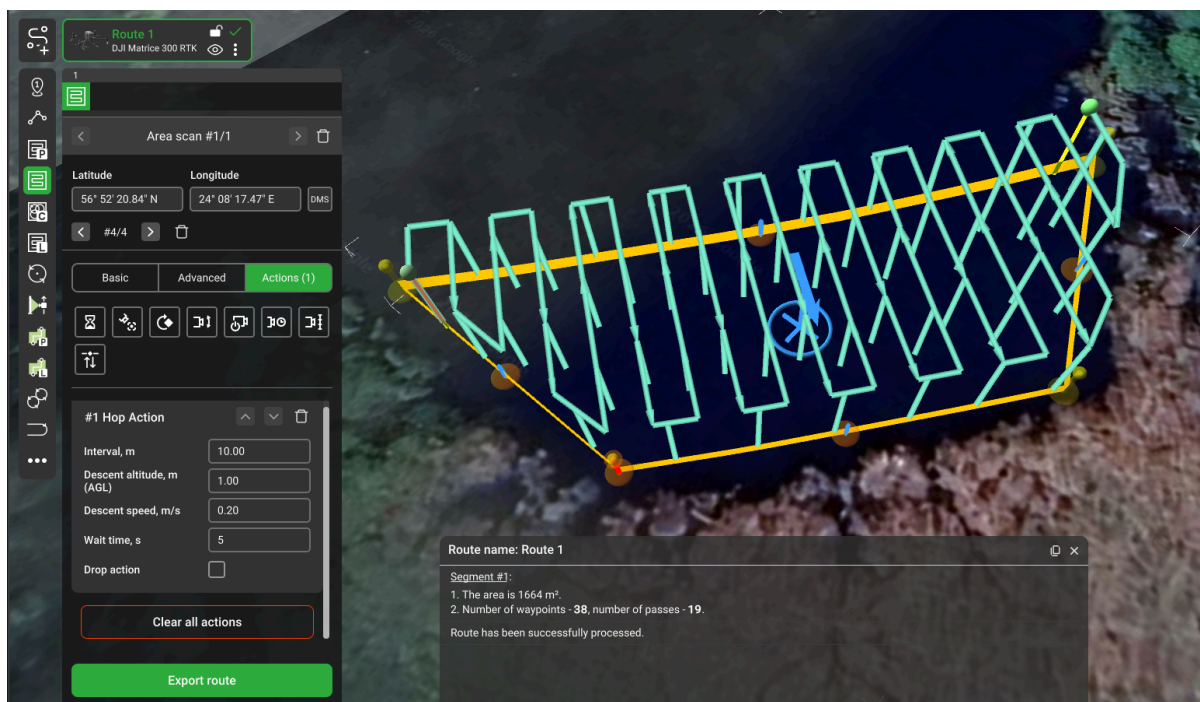


Figure 41.5. Grasshopper route is ready

## 41.4 Drop action



Figure 41.6. Drop action icon within UgCS software

The Drop action is primarily designed for the Water Sampling surveys. When added to a separate waypoint, it forces the Water Sampler to open at such a waypoint.

**Note** Drop action can only be used in combination with the SkyHub on-board computer; therefore, the waypoint altitude mode should be set to **Rangefinder**.

The rest of the Drop action parameters should be configured in Custom Payload Monitor and are described in the [Drop Messenger](#) section.

## 41.5 Flight process

Grasshopper mission execution is the same as any regular SkyHub rangefinder mission.

1. Upload the mission to the drone, either from the UgCS desktop or Companion app on your remote controller.
2. **Manually** arm the drone and perform a **manual** takeoff.
3. Move the drone towards the start of the mission.

4. Activate terrain-following.

---

**Note** Once terrain following is active, first thing the drone will do is ascent/descent to match the target altitude, and then will move towards the 1st waypoint with the **target altitude**.

---

|                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------|
| <p><b>Warning</b> Activate terrain following only if there are no obstacles in the line of flight to the first waypoint.</p> |
|------------------------------------------------------------------------------------------------------------------------------|

5. Based on the interval you select, there will be created additional waypoints (stop-points) along the route, representing the spots where the drone will stop and descent for the data collection.
6. When the drone reaches the stop-point, it will descent to the **descent altitude** value and collect the data for the duration you set in the **wait time** field.
7. After the data is collected, the drone will ascend back to the target altitude, move to the next stop-point and repeat the process.
8. After the mission is complete, the drone will stop at the last waypoint, then climbs to the **Safe altitude** value defined in the UgCS-CPM software.
9. **Manually** return the drone to the desired landing position, and perform **manual** landing.
10. Download the flight results (see [Log Files Management](#)).





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## Obstacle Avoidance

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The Obstacle Avoidance feature provides automated safety protection during drone operations by detecting and responding to obstacles in the flight path. This system continuously monitors the drone's surroundings and automatically executes configured safety actions when obstacles are detected within specified distances.

The Obstacle Avoidance system uses multiple sensor types to detect obstacles around your drone. When an obstacle is detected within your configured safety distance, the system automatically executes your chosen safety action (hover, return home, or do nothing).

---

### Note

- DJI drones have built-in obstacle avoidance sensors. Additionally, it is possible to attach a standalone radar sensor or an additional altimeter to both DJI and MAVLink-controlled drones.
- If you want to use both DJI and SkyHub obstacle avoidance at the same time, make sure the **Brake distance** value in DJI Pilot 2 is smaller than the **Safety distance** limit in SkyHub Obstacle Avoidance. Otherwise, the two algorithms can interfere with each other and lead to unpredictable behaviour.

---

There are two main obstacle avoidance setup use cases:

1. Perform the flight only with the built-in DJI obstacle avoidance sensors.
2. Perform the flight with built-in DJI obstacle avoidance sensors paired with an external radar or altimeter.

**Warning** In both scenarios, DJI built-in downward obstacle avoidance sensors must be disabled if the drone is carrying a payload beneath. Otherwise, the downward sensor will detect the payload as an obstacle, and the failsafe will be triggered.

External sensors are necessary to add an additional layer of security in conditions when built-in DJI sensors will fail: dark, snow, rain, fog, bright sun.

---

**Note** Do not forget to check if 77 GHz range sensors are permitted for use in your particular country.

---

### 42.1 Setup process

- Power on the system.
- Establish either the drone link or auxiliary connection with the SkyHub in the UgCS-CPM software.
- On the main screen of the UgCS-CPM, click on the “Settings” button.
- From the drop-down list, select “Obstacle avoidance”.
- Select the safety action.
- Select the activation altitude.

- Select the activation speed.
- Select the altitude source (source to measure if the drone has reached the activation altitude you set previously).
- Select the minimal safety distance threshold (minimal distance to the obstacle to detect. Values below this limit will be ignored).
- Select the safety distance limit (distance at which the failsafe will be triggered).
- (optional) Select the altimeter safety source (if your setup contains multiple altimeters and you wish to use one of them as a proximity source).
- (optional) Select the radar safety source (if your setup contains an external radar MR72).

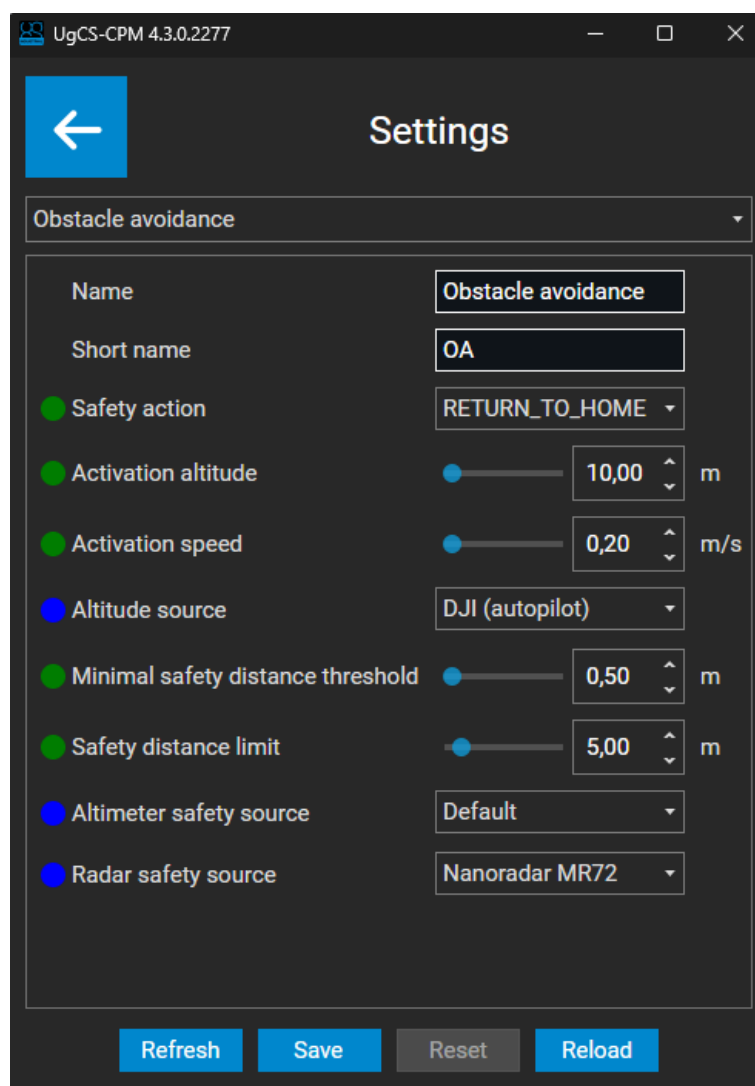


Figure 42.1. UgCS-CPM, Obstacle avoidance settings

When the drone is on the ground or hovering in the air, the obstacle avoidance system is in idle state. For obstacle avoidance to be armed and active, the drone must reach a certain altitude and speed, or the TTF/GH mission under SkyHub control must be activated.

Those values can be set in the “Settings” within the UgCS-CPM.

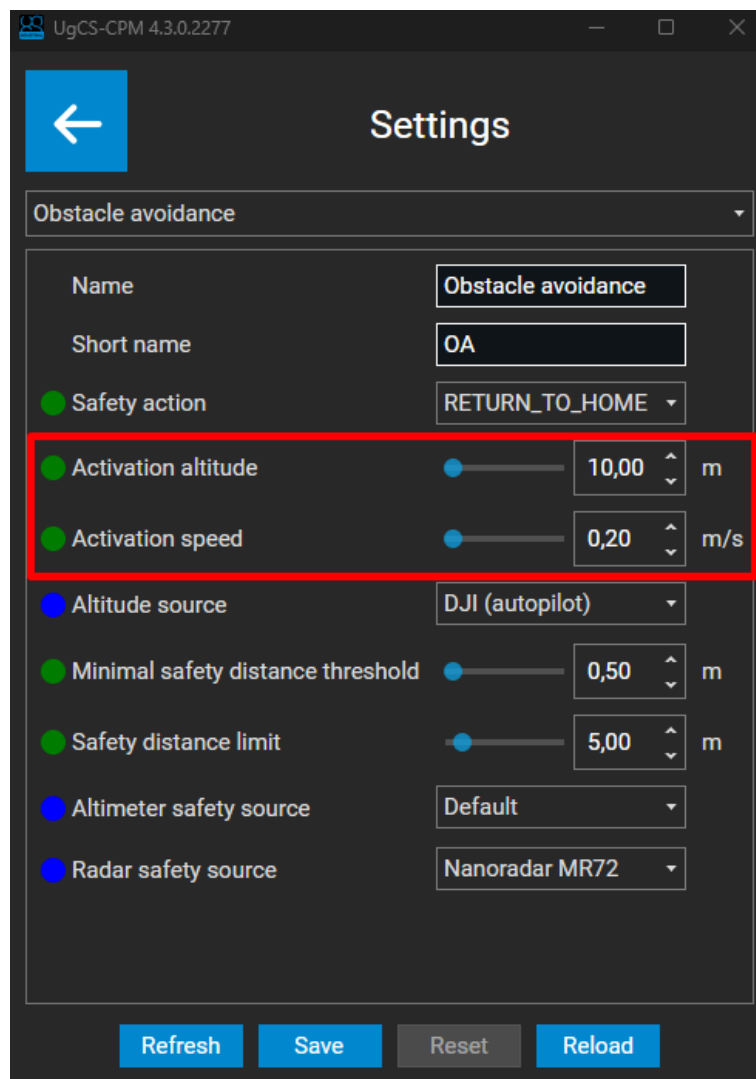


Figure 42.2. UgCS-CPM, Obstacle avoidance activation values

**Note** If no SkyHub mission is running, obstacle avoidance will be active only when both the activation altitude and activation speed are reached simultaneously. Otherwise, the system will be in idle state.

## 42.2 Safety actions

The safety action will determine the drone's behavior in case of close proximity to an object.

Here is the list of available actions you can choose from:

| Action         | Description                                         |
|----------------|-----------------------------------------------------|
| RETURN_TO_HOME | Stop mission and initiate automatic return to home. |
| STOP_AND_HOVER | Stop mission and maintain current position.         |
| WARNING        | Display warning message, continue mission.          |
| NOTHING        | No action will be taken, monitoring only.           |

### 42.3 Altitude sources

Within the Altitude source, you can select the elevation source that will be used to check whether your drone has reached the activation altitude.

There are multiple altitude sources you can choose from:

| Altitude source     | Description                                                                  |
|---------------------|------------------------------------------------------------------------------|
| Default             | Use your default altimeter to measure activation altitude.                   |
| DJI (autopilot)     | Use the DJI built-in barometric readings to measure activation altitude.     |
| Mavlink (autopilot) | Use the Mavlink built-in barometric readings to measure activation altitude. |
| Custom              | Use a custom source of elevation.                                            |

**Note** It is also possible to select the exact altimeter model from the list. This is designed for the flight cases if there are multiple altimeters mounted on the drone.

If your setup contains only one altimeter, choose between the “Default” or “Autopilot” values.

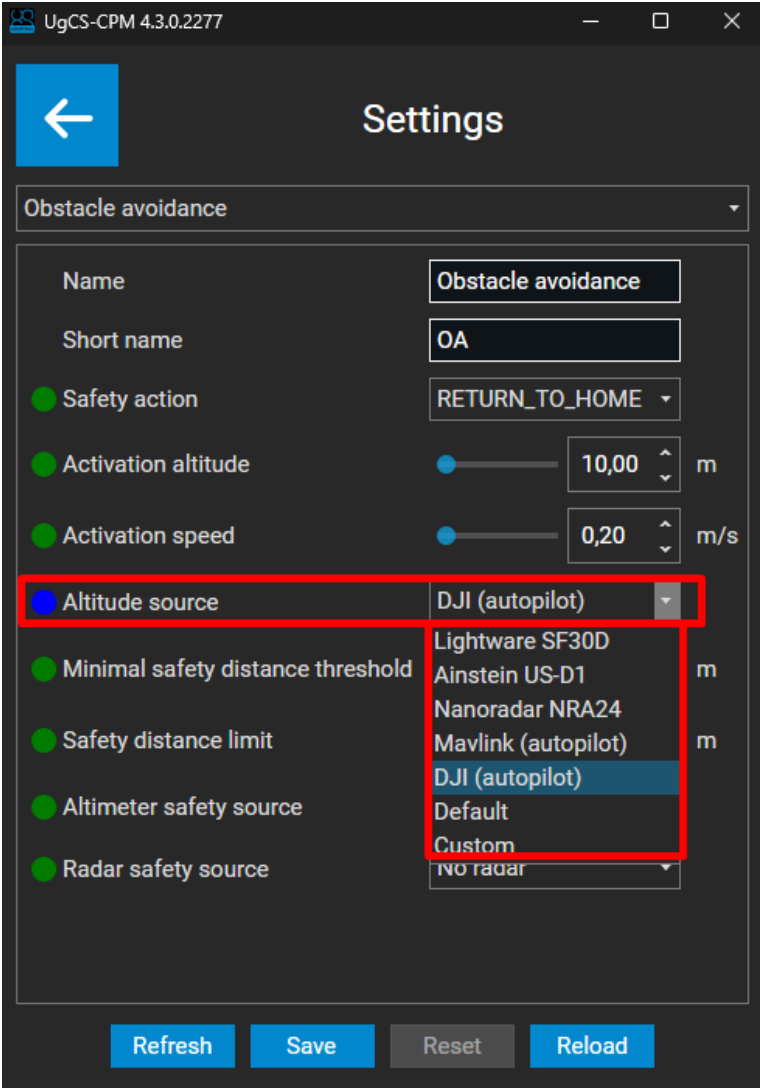


Figure 42.3. UgCS-CPM, Obstacle avoidance altitude sources

## 42.4 Safety sources

Within the safety sources, you can select the source you wish to use to measure the distance to an object (proximity).

There are three safety sources you can modify:

- **Altimeter safety source** - if your setup contains multiple altimeters and you want to use one of them to measure the distance to an object.
- **Radar safety source** - if your setup contains an external MR72 radar and you wish to use it to measure the distance to an object.
- **Embedded DJI sensors** – cannot be configured with UgCS-CPM. Instead, SkyHub will use sensors which are enabled with the DJI Pilot 2 application.

---

**Note** Embedded DJI obstacle avoidance (OA) sensors continue to work in parallel with the selected safety source, unless they are turned off in the Obstacle Avoidance settings.

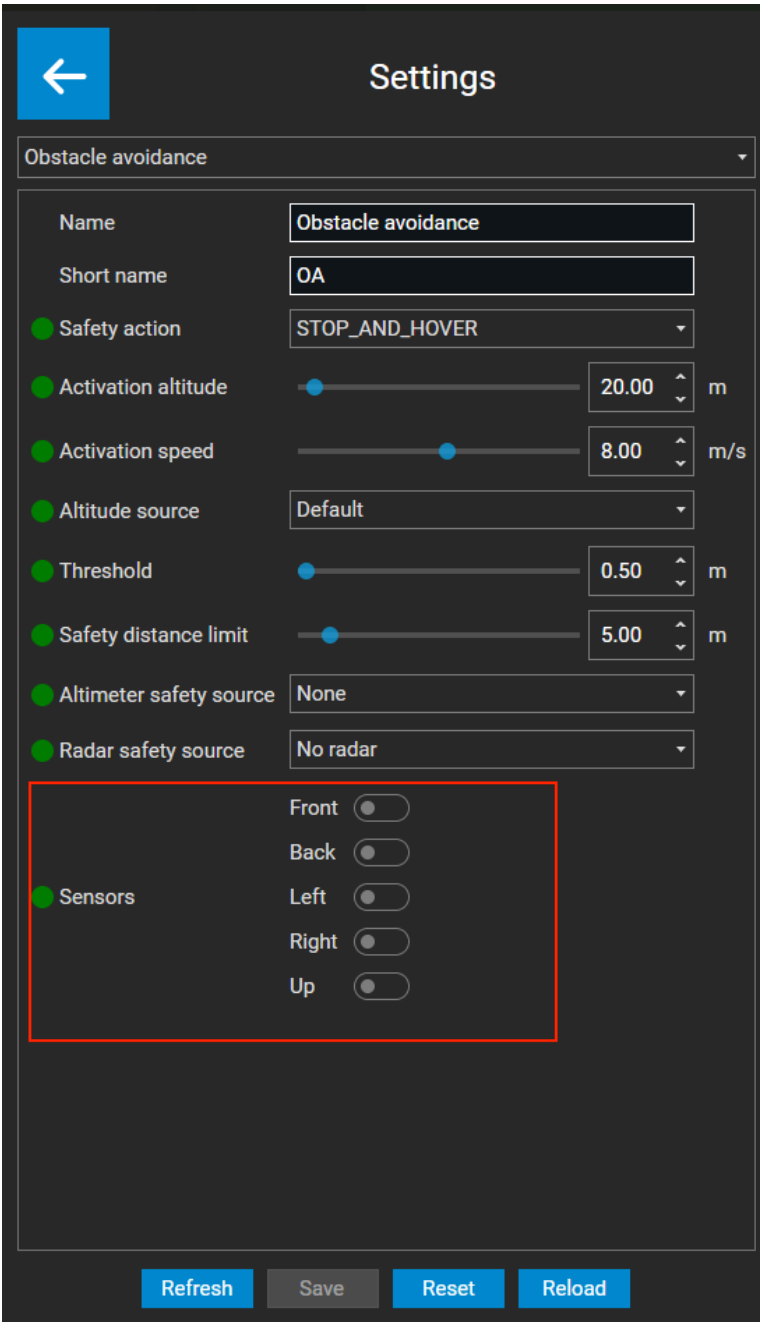


Figure 42.4. Obstacle Avoidance sensor toggles

**Warning** Do not modify Altimeter safety source if your setup contains only one altimeter. This field is designed only if your drone has multiple altimeters mounted at the same time.

42.4.1 Use case examples

1. If your setup contains only one altimeter (for the altitude measurement) and **no external MR72 radar**, your setup should be the following:
  - Altimeter safety source - None
  - Radar safety source - No radar

In this case, safety distance will be calculated from the built-in front DJI obstacle avoidance sensor.



Figure 42.5. UgCS-CPM, setup with no external radar

2. If your setup contains only one altimeter (for the altitude measurement) and you **have an external MR72 radar**, your setup should be the following:

- Altimeter safety source - None
- Radar safety source - Nanoradar MR72

In this case, safety distance will be calculated from the external Nanoradar MR72 mounted on the drone.

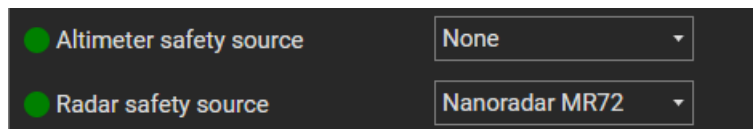


Figure 42.6. UgCS-CPM, setup with external radar

## 42.5 Configuration Parameters Summary

| Parameter           | Default        | Min | Max   | Precision | Unit | Options                                                                    | Description                                                         |
|---------------------|----------------|-----|-------|-----------|------|----------------------------------------------------------------------------|---------------------------------------------------------------------|
| Safety action       | STOP_AND_HOVER |     |       |           |      | RETURN_TO_HOME, STOP_AND_HOVER, WARNING, NOTHING                           | Drone action flying to close to obstacle                            |
| Activation altitude | 20.0           | 0.0 | 500.0 | 0.01      | m    |                                                                            | Obstacle Avoidance activation altitude                              |
| Activation speed    | 8.0            | 0.0 | 15.0  | 0.01      | m/s  |                                                                            | Obstacle Avoidance activation speed                                 |
| Altitude source     | Default        |     |       |           |      | Lightware SF30D, Ainstein US-D1, Nanoradar NRA24, DJI (autopilot), Default | Altitude source that will be used for obstacle avoidance activation |

|                         |                             |     |      |      |   |                                                                 |                                                                                 |
|-------------------------|-----------------------------|-----|------|------|---|-----------------------------------------------------------------|---------------------------------------------------------------------------------|
| Threshold               | 0.5                         | 0.0 | 50.0 | 0.01 | m |                                                                 | Minimal distance to obstacle to detect. Values below this limit will be ignored |
| Safety distance limit   | 5.0                         | 0.0 | 50.0 | 0.01 | m |                                                                 | Safety distance at which fail-safe is triggered                                 |
| Altimeter safety source | None                        |     |      |      |   | None, Lightware SF30D, Ainstein US-D1, Nanoradar NRA24, Default | Safety distance sources                                                         |
| Radar safety source     | No radar                    |     |      |      |   | Nanoradar MR72, No radar                                        | Safety distance sources                                                         |
| Sensors                 | FRONT BACK LEFT<br>RIGHT UP |     |      |      |   | Front, Back, Left, Right, Up                                    | Internal drone obstacle avoidance sensors to use                                |



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## About Log Files

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Logs are stored in the `skyhub_logs` folder on the microSD card.

There are two types of obligatory log files:

- Position log: `*-position.csv`
- System log: `*-system.log`

Position logs (`-position.csv` suffix) contain drone position data (GPS coordinates, attitude, altitude, etc.) followed by the payload's specific parameters, if any. For more details, see [Position Log](#).

**System logs (```-system.log``` extension) are a journal of various system events. Please keep them when contacting our support team.**

Also, depending on the specific payload used, you may get the following log files, for example:

- GPR data log in SEG-Y format: `*-gpr.sgy`
- Echosounder data log in SEG-Y format: `*-echo.sgy`
- Echosounder data log in NMEA format: `*-nmea.txt`
- Gas detector data log in NMEA format: `*-pergam-*.log`

GPR data logs (`-gpr.sgy` suffix) contain radar trace data in SEG-Y format. These files can be analyzed in PC applications such as Prism2 or similar software capable of reading and processing GPR data in SEG-Y format.

Echosounder data logs in SEG-Y format (`-echo.sgy` suffix) contain sounding trace data. These files can also be analyzed in the SEG-Y data processing software.

Echosounder data logs in NMEA 0183 format (`-nmea.txt` suffix) contain bathymetric data. These files can be processed in any software capable of handling data in NMEA 0183 format (e.g., ReefMaster).

Gas detector data logs in mixed NMEA 0183 + raw messages format (`-pergam.txt` suffix) contain measured concentration data.

The filename contains sequential numbers (`000001`, `000002`, etc.) before time synchronization and date/time (in `YEAR-MONTH-DAY-HOUR-MIN-SEC` format) after synchronization with GPS. The time is UTC.

Logging (except system log) is started only by command from UgCS-CPM (using the Record/Stop button) or automatically after taking off. The system log begins after onboard software is started.

Logs with the same file names have been created simultaneously. When the filename is to be changed (e.g., after time synchronization), a new set of logs is created.

The logs can be automatically divided by file size, time, trace count (GPR or echosounder only), and waypoints. This option is turned off by default. To enable it, set the corresponding parameters to values greater than zero in the [APP] section. More than one parameter can be set simultaneously. In this case, splitting will be fulfilled when the first of the selected conditions occurs:

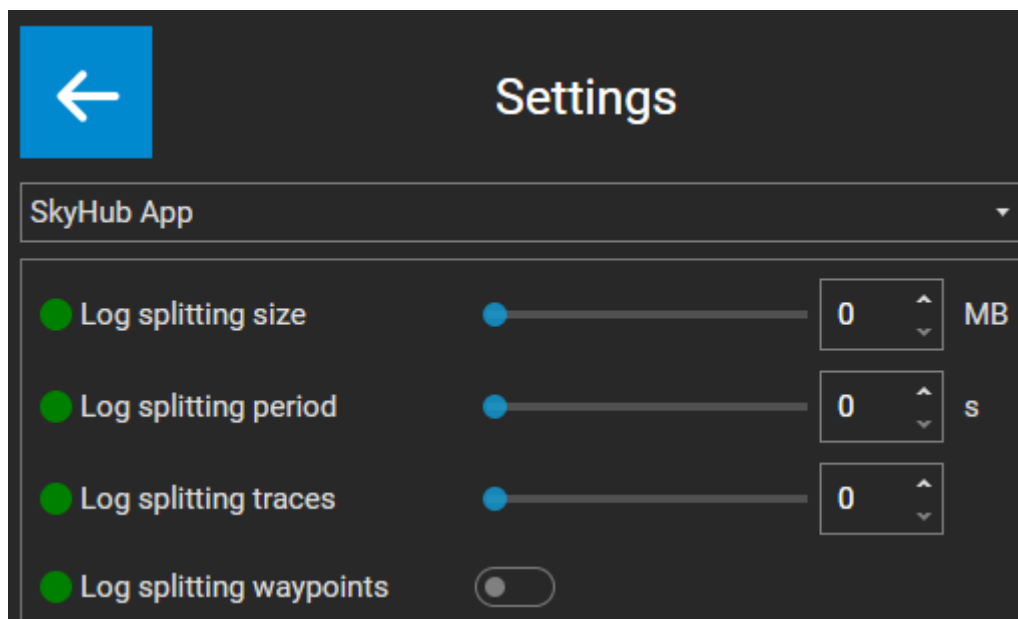


Figure 43.1. UgCS-CPM Logging Settings

When `LOG_SPLIT_WAYPOINTS` is set to 1 or another value greater than zero, each log file will contain one flight line with two waypoints.

For how to download log files using UgCS-CPM, see section [Log Files Management](#).

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## Position Log

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Position logs contain a common parameter group and the payload's specific parameters, if any. Common parameter columns are filled in with the latest received value. Specific payload columns are filled in at the moment when the payloads receive data, excluding altimeters, whose columns are written as common parameters.

New records are added to the Position Log at every unique timestamp when the payload column is updated. Updates for the common timestamp are merged into a single log record. If payloads don't receive data during a 100 ms period, the Position Log starts logging only common parameters at a 10 Hz rate.

### 44.1 Common Columns Description

| Header             | Unit | Description                                                                                                              |
|--------------------|------|--------------------------------------------------------------------------------------------------------------------------|
| Elapsed            | ms   | Number of milliseconds passed from the log manager process restart                                                       |
| Date               |      | Date received from the drone. Format: yyyy/M-M/dd                                                                        |
| Time               |      | UTC time received from the drone. Format: hh:mm:ss.ms                                                                    |
| Pitch              | deg  | Pitch angle of drone attitude                                                                                            |
| Roll               | deg  | Roll angle of drone attitude                                                                                             |
| Heading            | deg  | Yaw angle of drone attitude                                                                                              |
| Latitude           | deg  | GNSS coordinate of drone position (with RTK correction in RTK mode)                                                      |
| Longitude          | deg  | GNSS coordinate of drone position (with RTK correction in RTK mode)                                                      |
| Altitude           | m    | Drone altitude over home point in meters. Calculated as Fused altitude (reported by FC) minus starting point altitude.   |
| Next WP            |      | Index of next waypoint                                                                                                   |
| Velocity           | m/s  | Drone speed over ground (m/s)                                                                                            |
| RTK Status         |      | Is RTK mode ON or OFF                                                                                                    |
| Ellipsoidal Height | m    | GNSS altitude over globe. GPS/RTK depends on the mode. RTK altitude for the RTK mode. GPS altitude for the non-RTK mode. |
| ALT:Altitude       | m    | Altitude reported by configured altimeter.                                                                               |

## 44.2 Anemometer Columns Description

| Column name   | Unit | Description                                                                                          |
|---------------|------|------------------------------------------------------------------------------------------------------|
| AIR:Speed     | m/s  | Measured wind speed                                                                                  |
| AIR:Direction | deg  | Measured wind direction relative to magnetic north or sensor body according to sensor configuration. |

## 44.3 Altimeter Columns Description

| Column name  | Unit | Description                                                          |
|--------------|------|----------------------------------------------------------------------|
| ALT:Altitude | m    | Measured altitude                                                    |
| ALT:ID       |      | Identification string to distinguish values from multiple altimeters |

## 44.4 Echosounder Columns Description

| Column name        | Unit | Description                                                                                                                                                                                                                                                |
|--------------------|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ECHO:Depth         | m    | Measured depth                                                                                                                                                                                                                                             |
| ECHO:Depth Hi      | m    | Measured depth on high acoustic frequency. Support for dual frequency echosounder                                                                                                                                                                          |
| ECHO:Depth Lo      | m    | Measured depth on low acoustic frequency. Support for dual frequency echosounder                                                                                                                                                                           |
| ECHO:True Depth    | m    | Depth with taking into account sensor position relative to the waterline. True Depth calculates using ALT:Altitude value and the ECHOSOUNDER/CABLE_LENGTH_M configuration paramater.                                                                       |
| ECHO:True Depth Hi | m    | Depth on high acoustic frequency with taking into account sensor position relative to the waterline. True Depth Hi calculates using ALT:Altitude value and the ECHOSOUNDER/-CABLE_LENGTH_M configuration paramater. Support for dual frequency echosounder |
| ECHO:True Depth Lo | m    | Depth on low acoustic frequency with taking into account sensor position relative to the waterline. True Depth Hi calculates using ALT:Altitude value and the ECHOSOUNDER/-CABLE_LENGTH_M configuration paramater. Support for dual frequency echosounder  |
| ECHO:Temperature   | °C   | Temperature in degrees Celsius                                                                                                                                                                                                                             |
| ECHO:Trace         |      | Trace number in SEG-Y file                                                                                                                                                                                                                                 |
| ECHO:Trace Hi      |      | Trace number in SEG-Y file for high acoustic frequency. Support for dual frequency echosounder                                                                                                                                                             |
| ECHO:Trace Lo      |      | Trace number in SEG-Y file for low acoustic frequency. Support for dual frequency echosounder                                                                                                                                                              |
| ECHO:Pitch         | deg  | Pitch angle received from the payload                                                                                                                                                                                                                      |

|           |     |                                      |
|-----------|-----|--------------------------------------|
| ECHO:Roll | deg | Roll angle received from the payload |
|-----------|-----|--------------------------------------|

## 44.5 Cerulean Sonar Surveyor 240-16 Columns Description

| Column name      | Unit | Description                           |
|------------------|------|---------------------------------------|
| MBES:Depth       | m    | Measured depth                        |
| MBES:True Depth  | m    | Depth from the surface.               |
| MBES:Temperature | °C   | Temperature in degrees Celsius        |
| MBES:Pressure    | bar  | Water pressure in bars                |
| MBES:Pitch       | deg  | Pitch angle received from the payload |
| MBES:Roll        | deg  | Roll angle received from the payload  |

## 44.6 FluX Aero Methane Sniffer Columns Description

| Column name         | Unit | Description                   |
|---------------------|------|-------------------------------|
| GAS:Concentration 1 | ppm  | Concentration for gas 1       |
| GAS:Concentration 2 | ppm  | Concentration for gas 2       |
| GAS:Temp            | deg  | Sensor temperature in Celsius |

## 44.7 Falcon 1/2/Plus Columns Description

| Column name | Unit    | Description                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GAS:Methane | ppm × m | Measured concentration in ppm (parts per million) per meter                                                                                                                                                                                                                                                                                                                                             |
| GAS:Status  |         | Specific status for the payload: 0: on measuring (but the intensity is low, measure value is not accurate as 1); 1: on measuring (with good intensity level); 2-4: N/A; 5: not enough reflection (very low intensity, value is not accurate); 6: too much reflection (high density gas); 7: too much reflection (not able to measure by interfering of sunlight, etc...); 8: N/A; 9: stop, no measuring |

## 44.8 GPS Receiver Columns Description

| Column name    | Unit | Description                                 |
|----------------|------|---------------------------------------------|
| GNSS:Date      |      | Date                                        |
| GNSS:Time      |      | Time                                        |
| GNSS:Latitude  | deg  | Latitude                                    |
| GNSS:Longitude | deg  | Longitude                                   |
| GNSS:Altitude  | m    | Altitude above/below mean-sea-level (geoid) |

|                        |   |                                                                                                                                                                                             |
|------------------------|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| GNSS:Quality Indicator |   | GPS Quality Indicator: 0: fix not available; 1: GPS fix; 2: Differential GPS fix; 3: PPS fix; 4: RTK; 5: float RTK; 6: estimated (dead reckoning); 7: manual input mode; 8: simulation mode |
| GNSS:Satellites        |   | Number of satellites in use                                                                                                                                                                 |
| GNSS:HDOP              | m | Horizontal dilution of precision                                                                                                                                                            |
| GNSS:Undulation        | m | Geoidal separation, the difference between the WGS-84 earth ellipsoid and mean-sea-level (geoid). Negative value means mean-sea-level below ellipsoid                                       |

## 44.9 Ground-Penetrating Radar Columns Description

| Column name | Unit | Description                |
|-------------|------|----------------------------|
| GPR:Trace   |      | Trace number in SEG-Y file |

## 44.10 Ebinger VEMOS AIR Columns Description

| Column name  | Unit | Description                             |
|--------------|------|-----------------------------------------|
| MD:Sensor ID |      | Configured sensor identifier PAYLOAD_ID |
| MD:Value     |      | Value from the sensor                   |

## 44.11 Obstacle Detector Columns Description

| Column name | Unit | Description                                                       |
|-------------|------|-------------------------------------------------------------------|
| OBS:Sector1 | m    | Distance to the nearest obstacle in the sector 1                  |
| OBS:Sector2 | m    | Distance to the nearest obstacle in the sector 2 (central sector) |
| OBS:Sector3 | m    | Distance to the nearest obstacle in the sector 3                  |
| OBS:ID      |      | Number of instance which generated the record                     |

## 44.12 Lightware SF30/D Altimeter Description

| Column name | Unit | Description                    |
|-------------|------|--------------------------------|
| SF:RawF     | m    | First return raw               |
| SF:FiltF    | m    | First return filtered          |
| SF:SgthF    | %    | First return strength          |
| SF:RawL     | m    | Last return raw                |
| SF:FiltL    | m    | Last return filtered           |
| SF:SgthL    | %    | Last return strength           |
| SF:Noise    |      | Background noise               |
| SF:Temp     | °C   | Temperature in degrees Celsius |

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## Log Files Management

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### 45.1 Access to the log files

1. Establish an Auxiliary connection to the SkyHub using Wi-Fi or through the Ethernet cable. See [Preparation](#) guide for instructions.
2. When the Auxiliary connection is established, launch the UgCS-CPM software.
3. Click on the “Tools” section.
4. From the drop-down list select the “Logs management”.

### 45.2 Data download

1. Press the Browse button to choose the destination folder for log files.
2. Select the desired date and file extensions you wish to download.
3. Press the “Download” button and wait for the process to complete.

---

**Note** After the log files are no longer needed, you can delete them all using the “Erase All” button.

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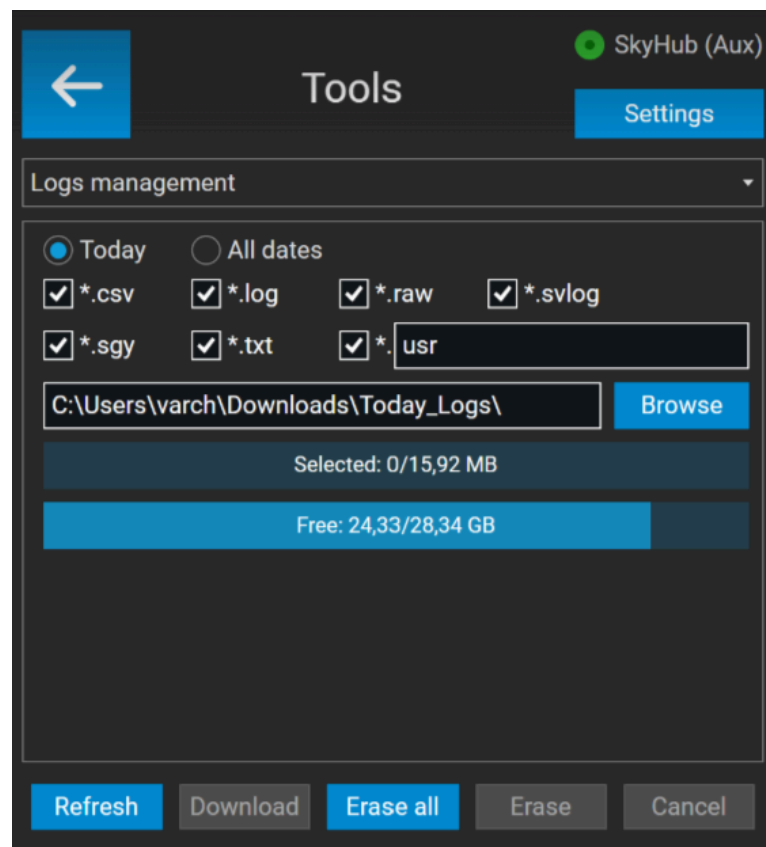


Figure 45.1. UgCS-CPM Log management window



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## Upgrade/Downgrade Firmware

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**Note** All manipulations with the firmware can be done only over the Auxiliary connection.

---

**Warning** The firmware version on the SkyHub must match the UgCS-CPM version on your computer. If there is a version mismatch, you will get a system message accordingly.

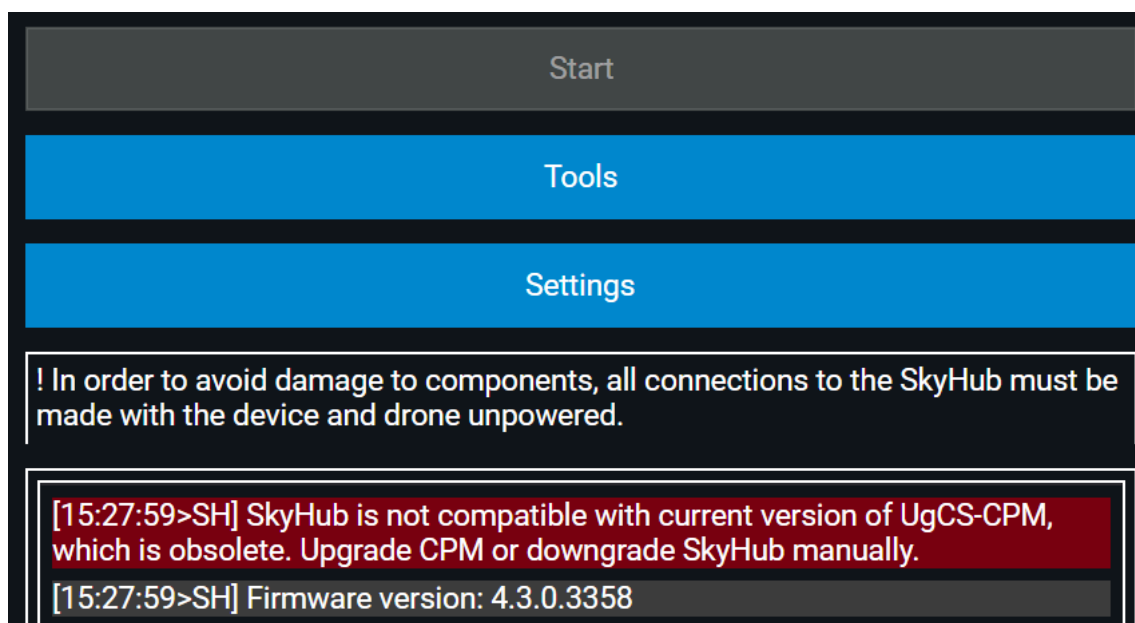


Figure 46.1. UgCS-CPM Firmware mismatch message

### 46.1 Firmware upgrade process

In general, if the UgCS-CPM version on your computer is newer than the firmware version on the SkyHub, upon establishing the Auxiliary connection, you will receive the popup notification, with the changelog.

You can confirm, accept, and install the upgrade right away.

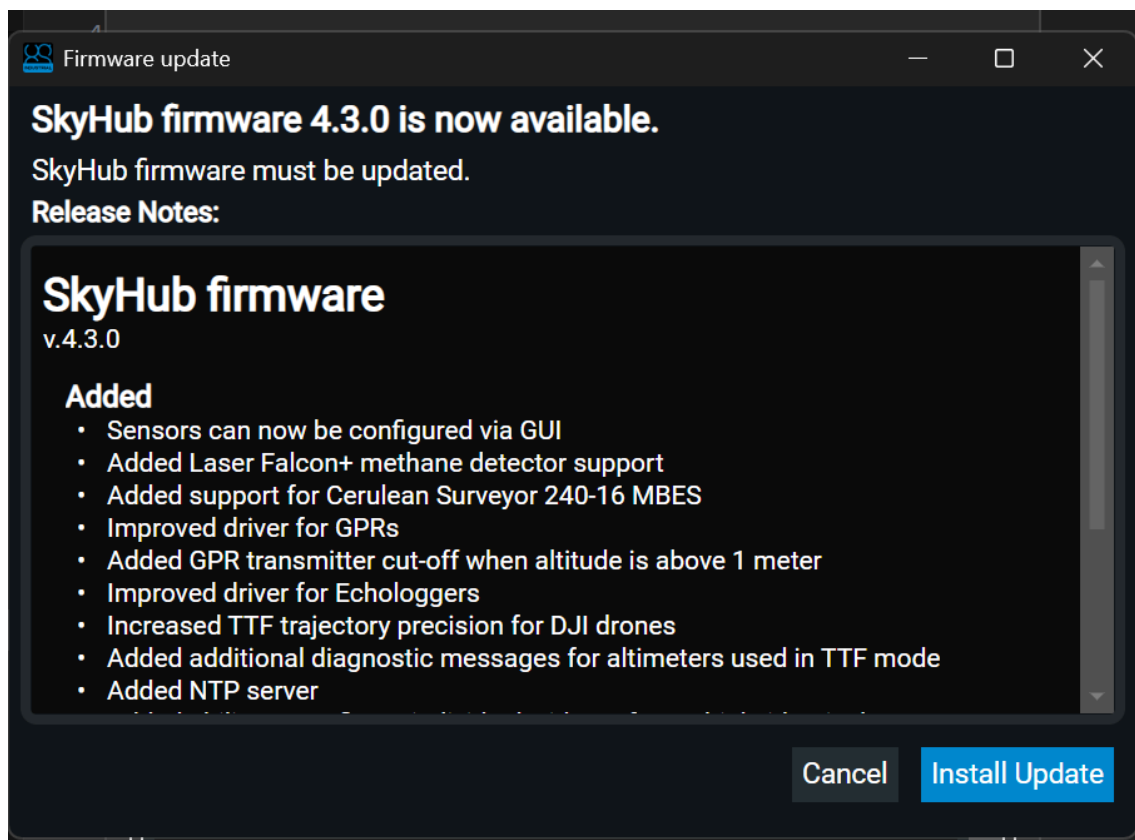


Figure 46.2. UgCS-CPM Firmware upgrade popup

Alternatively, it is possible to initiate the upgrade process manually, by selecting an exact version you wish to upgrade to:

1. Connect the PC to the SkyHub using Wi-Fi or by Ethernet cable. See [Preparation](#) guide for instructions.
2. Open UgCS-CPM and go to “Tools”.
3. From the drop-down list, select “Manage SkyHub”.
4. Click the “Browse” button and select the firmware file you wish to upgrade to.

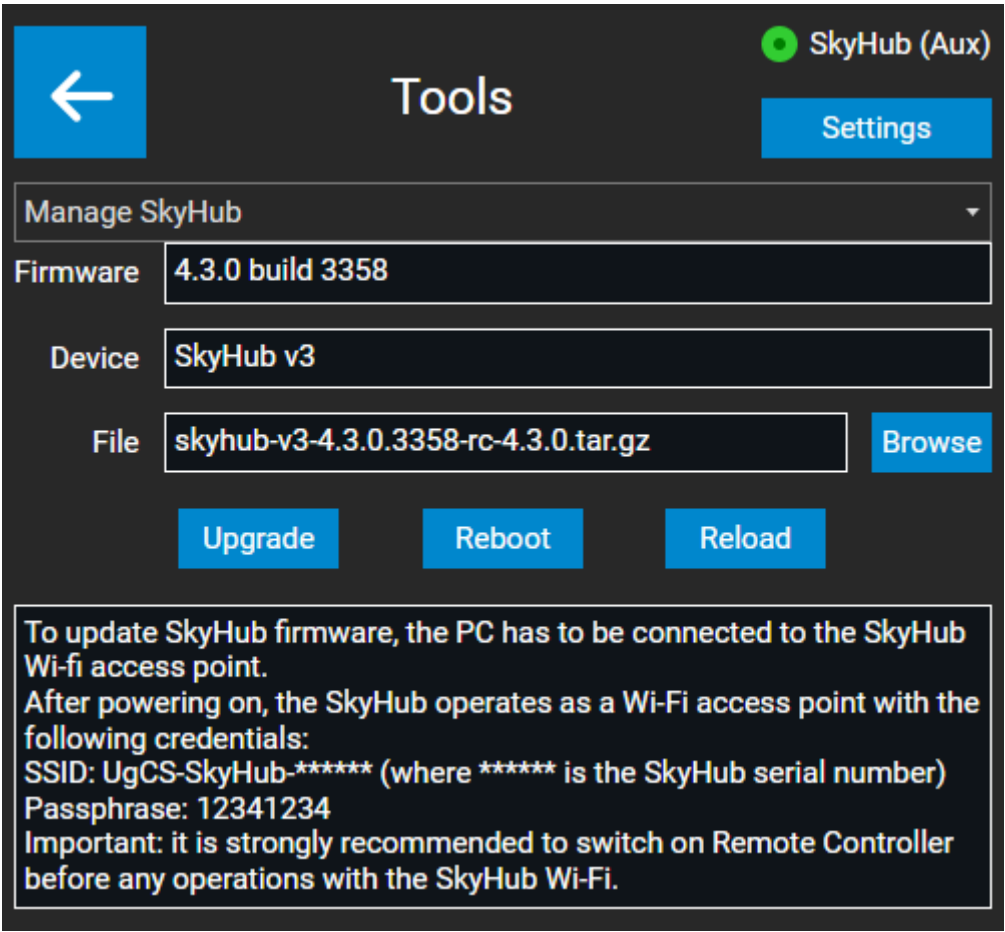


Figure 46.3. UgCS-CPM Manage SkyHub Section

**Note** The latest SkyHub firmware compatible with the installed UgCS-CPM is located in *UgCS-CPM/firmware* folder - *C:/Program Files (x86)/UgCS-CPM/firmware*

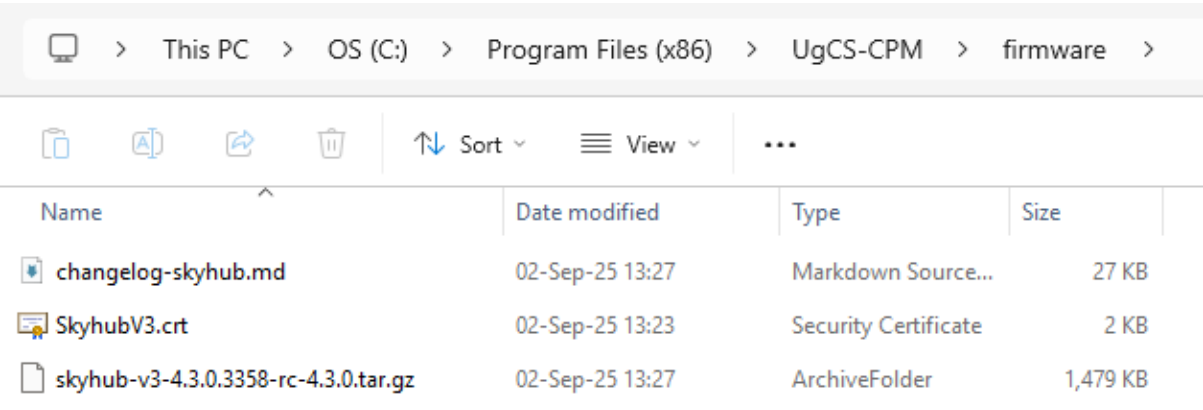


Figure 46.4. UgCS-CPM Firmware folder

- 5. When the firmware is selected, press the “Upgrade” button.
- 6. Firmware installation will start.

---

**Note** The upgrade process takes around 10 - 15 minutes. First, the firmware is uploaded to SkyHub, then the installation process starts automatically and will complete even if the connection with SkyHub is lost. If the firmware update is run over Wi-Fi, the connection with SkyHub will be lost once SkyHub restarts after the upgrade. Look for SkyHub Wi-Fi to appear in the Windows Wi-Fi list and reconnect. If the firmware update is run over Ethernet, the connection with SkyHub will be established automatically after the restart.

---

## 46.2 Firmware downgrade process

The downgrade process is quite similar to the upgrade. The only difference is that after the SkyHub firmware downgrade, you must reinstall the UgCS-CPM software as well to match the versions.

1. Connect the PC to the SkyHub using Wi-Fi or by Ethernet cable. See [Preparation](#) guide for instructions.
2. From the drop-down list, select “Manage SkyHub”.
3. Click the “Browse” button and select the firmware file you wish to downgrade to.
4. Click the “Upgrade” button.
5. Wait for the downgrade process to finish.
6. Uninstall the current UgCS-CPM version and install the corresponding version for the firmware you just downgraded to.
7. Downgrade is complete.

---

**Note** Depending on the version you are downgrading to, it might be necessary to delete the existing configuration file and reconfigure both autopilot and payloads from scratch.

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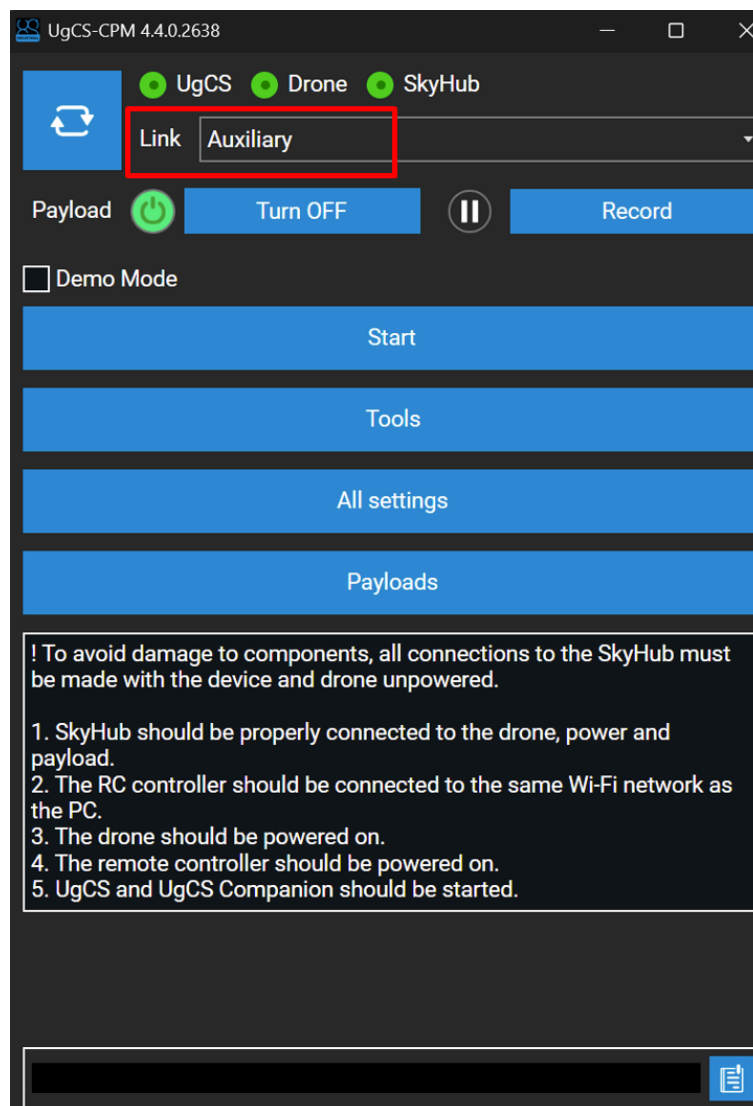
## Factory Reset

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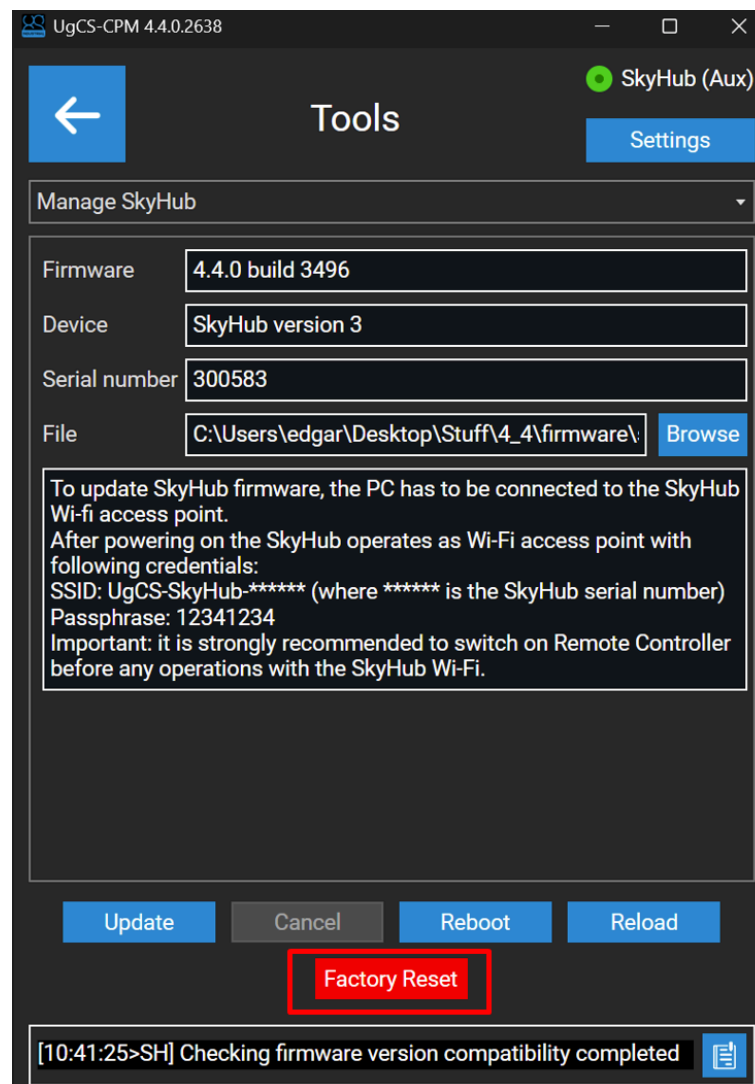
**Note** Factory reset can be performed only over the auxiliary connection. Connect to SkyHub directly over the WiFi or Ethernet to proceed.

---

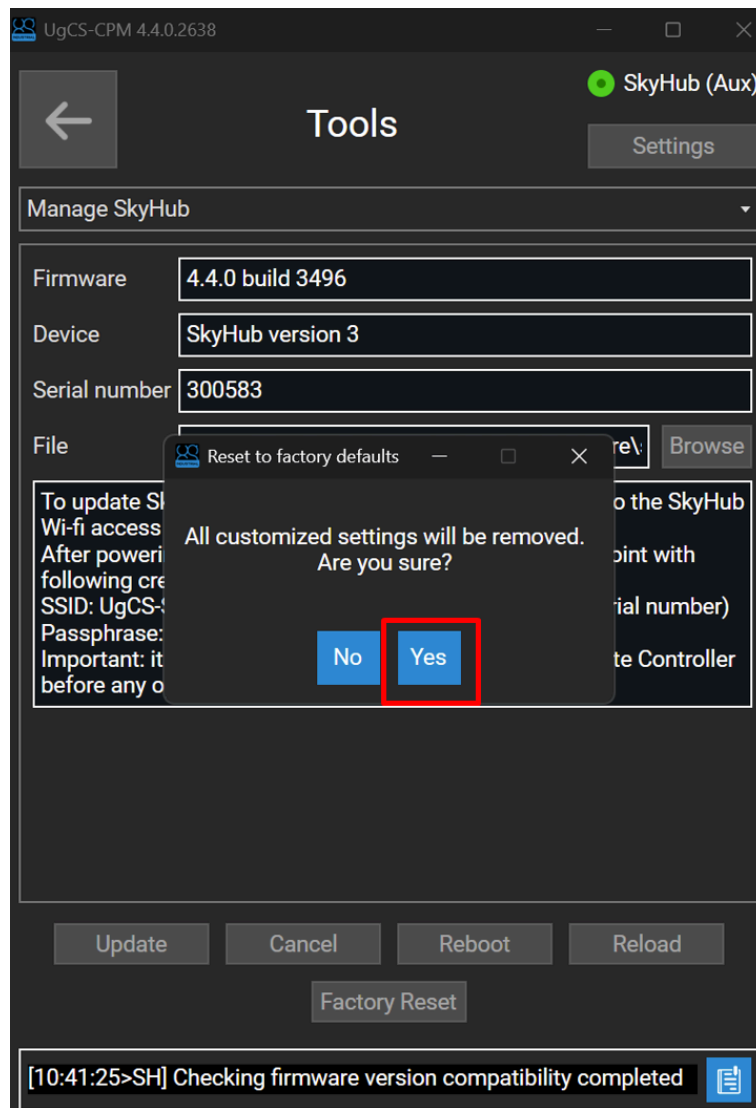
1. Establish Auxiliary connection to the SkyHub.



2. Next, navigate to the “Tools” section, and from the drop-down list select the “Manage SkyHub” section.
3. Next, press the red “Factory Reset” button.

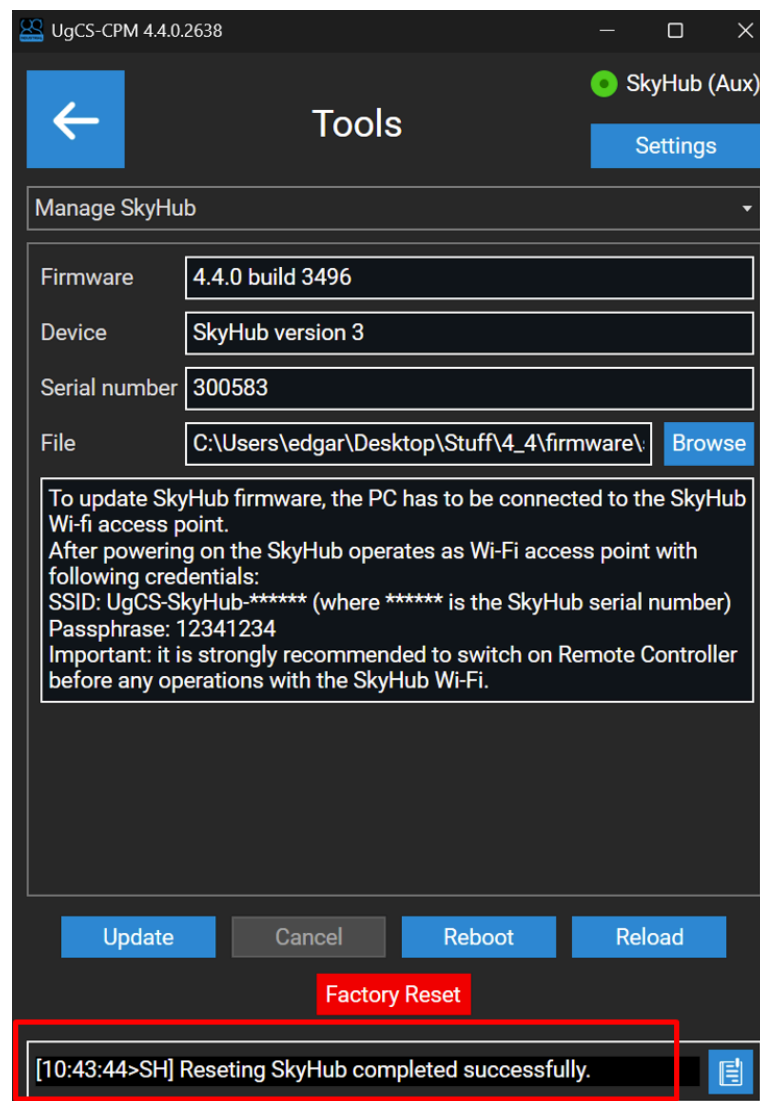


4. Confirm the reset.



**Warning** Factory reset process will delete existing SkyHub configuration file, and create a new, default configuration instead.

5. After the confirmation, reset process will begin. It may take a few minutes, make sure to **wait for the confirmation message** before moving on.



**Warning** It is important to wait for the confirmation message before proceeding with the configuration. If, the process will be interrupted, it it will be necessary to initiate the reset one more time.

6. Factory reset is complete. You can now proceed with the autopilot and payload configuration.



## Configuration Parameter Reference

### 48.1 SkyHub Configuration Parameters

#### 48.1.1 Application Settings

| Parameter                  | Default | Min | Max   | Precision | Unit | Description                                                                                      |
|----------------------------|---------|-----|-------|-----------|------|--------------------------------------------------------------------------------------------------|
| Log splitting size         | 0       | 0   | 10000 | 1         | MB   | Log splitting by file size, MB                                                                   |
| Log splitting period       | 0       | 0   | 36000 | 1         | s    | Period of log splitting, seconds                                                                 |
| Log splitting traces       | 0       | 0   | 1000  | 1         |      | Log splitting by trace number (applicable to GPR and echosounder only)                           |
| Log splitting waypoints    | False   |     |       |           |      | Log splitting by waypoint count. If set to 1, each log will contain one line with two waypoints. |
| Minimum free space         | 300     | 0   | 10000 | 1         | MB   | Minimum allowable free space of internal SkyHub memory, MB                                       |
| Payloads start delay       | 5       | 0   | 36000 | 1         | s    | Delay of payload plugin startup, seconds                                                         |
| Payload status period      | 500     | 0   | 36000 | 1         | ms   | Period of payload status sending to ground, ms                                                   |
| Telemetry refresh period   | 200     | 0   | 36000 | 1         | ms   | Telemetry data refresh period, ms                                                                |
| System information monitor | False   |     |       |           |      | Enable system load statistics log sysinfo.log                                                    |
| Sysinfo period             | 1.0     | 0   | 60    | 0.1       | s    | Pooling period to write new records                                                              |
| Log the debug info         | False   |     |       |           |      | Enable debug log level for system.log                                                            |
| Green LED                  | False   |     |       |           |      | Initial state for the Green LED pin (GPIO20). True = high state False = low state                |
| Red LED                    | False   |     |       |           |      | Initial state for the Red LED pin (GPIO21). True = high state False = low state                  |
| Payload Power pin          | False   |     |       |           |      | Initial state for the Payload Power pin (GPIO24). True = high state False = low state            |

#### 48.1.2 Autopilots Settings

| Parameter     | Default | Unit | Description                                      |
|---------------|---------|------|--------------------------------------------------|
| DJI M300/M350 | False   |      | Enable SkyHub communication with DJI M300 / M350 |

|          |       |  |                                                                  |
|----------|-------|--|------------------------------------------------------------------|
| DJI M400 | False |  | Enable SkyHub communication with DJI M400. Experimental feature. |
| MAVLINK  | False |  | Enable SkyHub communication with Pixhawk based autopilots        |

### 48.1.3 Obstacle Avoidance Settings

| Parameter               | Default                  | Min | Max   | Precision | Unit | Options                                                                    | Description                                                                     |
|-------------------------|--------------------------|-----|-------|-----------|------|----------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| Safety action           | STOP_AND_HOVER           |     |       |           |      | RETURN_TO_HOME, STOP_AND_HOVER, WARNING, NOTHING                           | Drone action flying to close to obstacle                                        |
| Activation altitude     | 20.0                     | 0.0 | 500.0 | 0.01      | m    |                                                                            | Obstacle Avoidance activation altitude                                          |
| Activation speed        | 8.0                      | 0.0 | 15.0  | 0.01      | m/s  |                                                                            | Obstacle Avoidance activation speed                                             |
| Altitude source         | Default                  |     |       |           |      | Lightware SF30D, Ainstein US-D1, Nanoradar NRA24, DJI (autopilot), Default | Altitude source that will be used for obstacle avoidance activation             |
| Threshold               | 0.5                      | 0.0 | 50.0  | 0.01      | m    |                                                                            | Minimal distance to obstacle to detect. Values below this limit will be ignored |
| Safety distance limit   | 5.0                      | 0.0 | 50.0  | 0.01      | m    |                                                                            | Safety distance at which fail-safe is triggered                                 |
| Altimeter safety source | None                     |     |       |           |      | None, Lightware SF30D, Ainstein US-D1, Nanoradar NRA24, Default            | Safety distance sources                                                         |
| Radar safety source     | No radar                 |     |       |           |      | Nanoradar MR72, No radar                                                   | Safety distance sources                                                         |
| Sensors                 | FRONT BACK LEFT RIGHT UP |     |       |           |      | Front, Back, Left, Right, Up                                               | Internal drone obstacle avoidance sensors to use                                |

#### 48.1.4 Altimeter Settings

| Parameter         | Default         | Min | Max  | Precision | Unit | Options                                                                                                   | Description                                                                                                           |
|-------------------|-----------------|-----|------|-----------|------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Max               | 20              | 1   | 100  | 0.1       | m    |                                                                                                           | Higher value from sensor will appear red                                                                              |
| Min               | 1               | 0.1 | 100  | 0.1       | m    |                                                                                                           | Lower value from sensor will appear red                                                                               |
| Safe altitude     | 5               | 0.1 | 50   | 0.1       | m    |                                                                                                           | Safe altitude drone will take in case of failsafe or at the end of the route                                          |
| Ignore errors     | 0               | 0   | 1000 | 1         |      |                                                                                                           | Maximum number of ignoring fails received in a row                                                                    |
| Default altimeter | v1:altimeter::0 |     |      |           |      | Lightware SF30D, Ainstein US-D1, Nanoradar NRA24, Mavlink (autopilot), The first configured altimeter     | Default altimeter selection for flight navigation                                                                     |
| Active altimeter  | Default         |     |      |           |      | Lightware SF30D, Ainstein US-D1, Nanoradar NRA24, Mavlink (autopilot), Default, All Configured Altimeters | Altimeter which readings are used for position data. Must be selected when SkyHub altimeter is forwarded over Mavlink |

#### 48.1.5 Mavlink Settings

| Parameter           | Default             | Min | Max | Precision | Unit | Options                                | Description                                                  |
|---------------------|---------------------|-----|-----|-----------|------|----------------------------------------|--------------------------------------------------------------|
| Connection type     | UART                |     |     |           |      | UART, TCP, UDP                         | Connection type - UART, TCP or UDP                           |
| SkyHub interface    | Connector #3 (AMA2) |     |     |           |      | Connector #2 (S0), Connector #3 (AMA2) | Serial connection port or IP address for TCP / UDP           |
| Baud rate / port    | 230400              |     |     |           |      | 230400, 460800, 921600                 | Serial port baudrate or port number for TCP / UDP connection |
| Component ID        | 5                   | 1   | 200 | 1         |      |                                        | Mavlink Component ID                                         |
| System ID           | 2                   | 1   | 200 | 1         |      |                                        | Mavlink System ID                                            |
| Use drone altimeter | True                |     |     |           |      |                                        | Must be disabled, if SkyHub altimeter data is forwarded      |

|                        |       |   |      |    |    |  |                                                                            |
|------------------------|-------|---|------|----|----|--|----------------------------------------------------------------------------|
| Use SkyHub altimeter   | False |   |      |    |    |  | Data from SkyHub altimeter will be forwarded to autopilot                  |
| Ground data interval   | 20    | 0 | 1000 | 10 | ms |  | Sending interval of sensor data from internal queue to the ground station. |
| Telemetry rate         | 10    | 0 | 100  | 10 | Hz |  | Telemetry frequency, Hz                                                    |
| V2 Extension           | True  |   |      |    |    |  | Using MAVLink V2_EXTENSION messages                                        |
| Altimeter Component ID | 5     | 1 | 200  | 1  |    |  | Mavlink Component ID for SkyHub altimeter                                  |
| Altimeter System ID    | 2     | 1 | 200  | 1  |    |  | Mavlink System ID for SkyHub altimeter                                     |
| Mavlink Payload ID     | 192   | 1 | 200  | 1  |    |  | Mavlink Payload ID for SkyHub altimeter                                    |

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