SPH Engineering

# SkyHub

**Revision 4.3**

*October 2025*

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.

Table of Contents

# List of Figures

**Warning**

**Note**

Chapter 1

# Description

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, echo sounder, 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.

## 1.1 Compatible drones

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

## 1.2 Interaction diagrams with drones

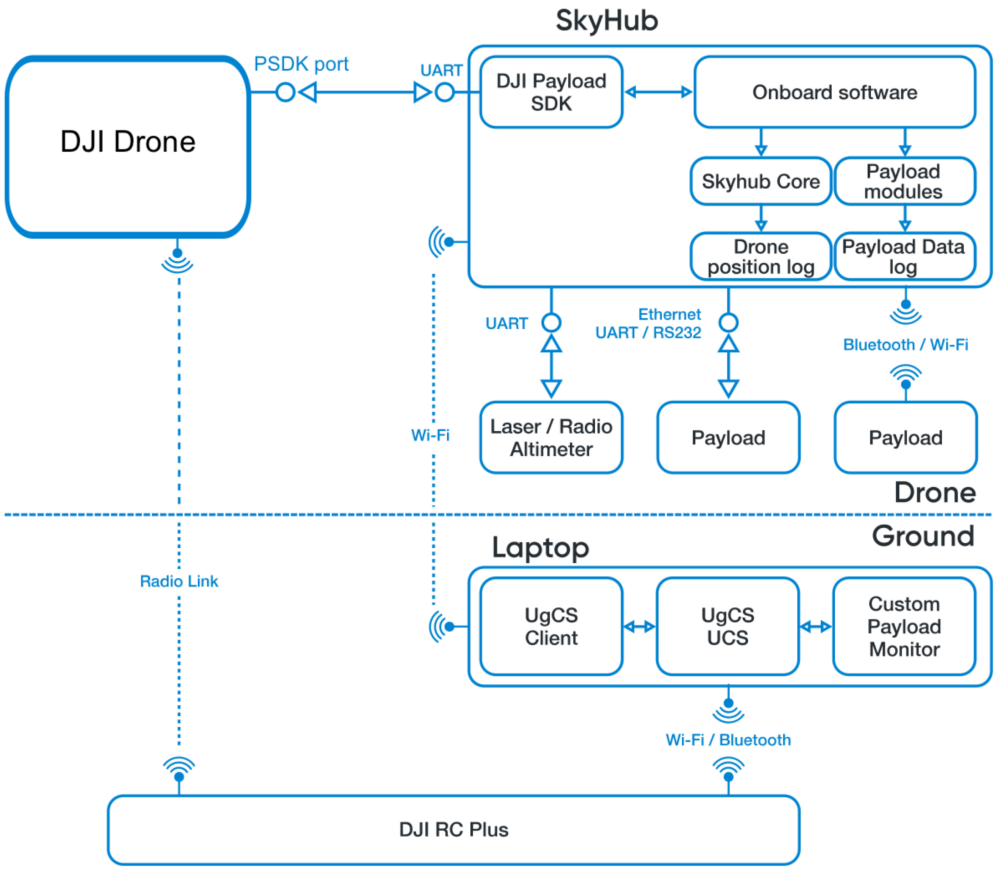



Figure 1.1. DJI SDK drone interaction diagram

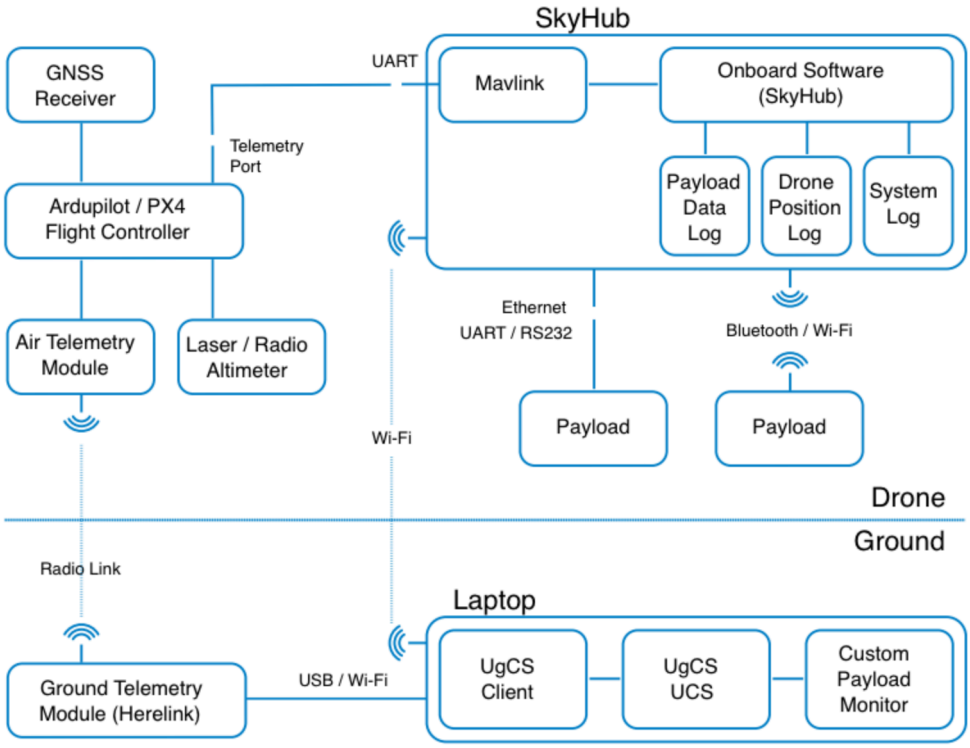



Figure 1.2. Pixhawk autopilot based drone interaction diagram

# Supported sensors

## 2.1 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 | Notes |
|---|---|---|---|---|---|
| Nanoradar | NRA24 | YES | UART | YES | Max range: 50 m |
| LightWare Lidar | SF30/D | YES | UART | YES | Max range: 200 m |
| Ainstein AI | US-D1 | YES | UART | YES | |

## 2.2 Ground-Penetrating Radar (GPR)

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

## 2.3 Magnetometer

| Manufacturer | Sensor name | Data logging on Skyhub | Data / control interface | Power feed from Skyhub | Notes |
|---|---|---|---|---|---|
| SENSYS | MagDrone R3 / R4 | - | - | YES | GPS feed (GPS-out) from Skyhub |
| SENSYS | MagDrone R1 | Yes | USB | YES | |

| | | | | | |
|---|---|---|---|---|---|
| SPH Engineering | MagNIMBUS (with QuSpin Gen-2 magne-tometer sensor) | Yes | UART | YES | |

## 2.4 Echosounders

| Manufacturer | Sensor name | Data logging on Skyhub | Data / control interface | Power feed from Skyhub | Notes |
|---|---|---|---|---|---|
| Echologger | ECT400 | YES | RS-232 | YES | Optionally USB |
| Echologger | ECT D052 | YES | RS-232 | YES | Optionally USB |
| Echologger | ECT D032 | YES | RS-232 | YES | Optionally USB |
| Echologger | ECT D24 | YES | RS-232 | YES | Optionally USB |
| Cerulean | Surveyor 240-16 MBES | YES | Ethernet | YES | |

## 2.5 Methane detector

| Manufacturer | Sensor name | Data logging on Skyhub | Data / control interface | Power feed from Skyhub | Notes |
|---|---|---|---|---|---|
| Pergam | Laser Falcon | YES | USB | YES | |
| Pergam | Laser Falcon 2 | YES | UART | YES | |
| Pergam | Laser Falcon Plus | YES | Ethernet | YES | |
| Axetris | FluX Aero Methane Sniffer | YES | UART | YES | |

## 2.6 Metal detector

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

## 2.7 Other sensors and devices

| Manufacturer | Sensor name | Data logging on Skyhub | Data / control interface | Power feed from Skyhub | Notes |
|---|---|---|---|---|---|
| FT Technologies | FT742 anemometer | YES | UART | YES | |
| FT Technologies | FT602 anemometer | YES | UART | YES | |
| Nanoradar | MR72 obstacles detector | YES | UART | YES | |

| | | | | | |
|---|---|---|---|---|---|
| Emlid | Reach M2 | YES | UART / USB | - | |
| SPH Engineering | Water sampler messenger release device | - | GPIO / PWM | YES | Tested with Ruttner water sampler |
| Geolux | LX-80 | YES | UART / CAN | YES | |
| Geolux | RSS2-300W | YES | UART / CAN | YES | |

Chapter 3

# Legal Notice

SPH Engineering reserves the right to make corrections, enhancements, improvements and other changes to its products and services and to discontinue any product or service.

Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete.

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of our products in its applications, notwithstanding any applications-related information or support that may be provided by SPH Engineering. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify SPH Engineering and its representatives against any damages arising out of the use of any of our products in safety-critical applications.

## 3.1 Disclaimer

Information in this document is subject to change without notice and does not represent a commitment on the part of SPH Engineering. SPH Engineering provides this document “as is” without warranty of any kind, expressed or implied, including, but not limited to, the implied warranties of fitness or merchantability for a particular purpose. SPH Engineering may make improvements and/or changes in this document or in the product(s) and/or the program(s) described in this document at any time.

## 3.2 Trademarks

**UgCS** is a registered trademark of SPH Engineering.

All other trademarks and registered trademarks mentioned in this document are the property of their respective owners.

## 3.3 Document License



## 3.4 Contact & Support

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

For support and inquiries:

- Email: support@sphengineering.com
- Website: https://www.sphengineering.com/support

# Preparation

## 4.1 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.

### 4.1.1 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.

---

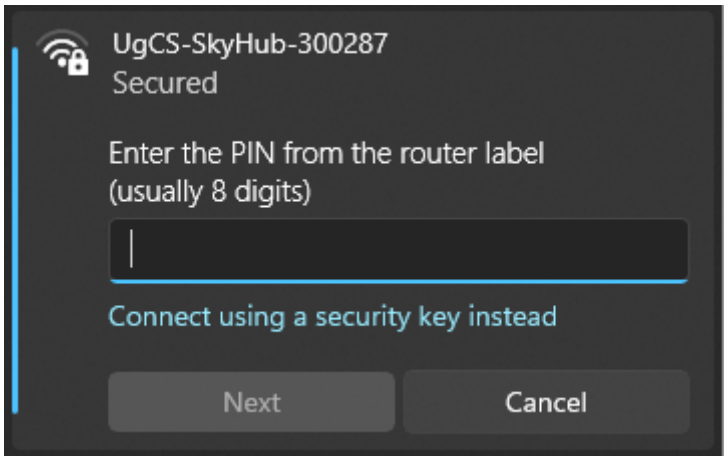



Figure 4.1. Windows Wi-Fi connection dialog. PIN mode

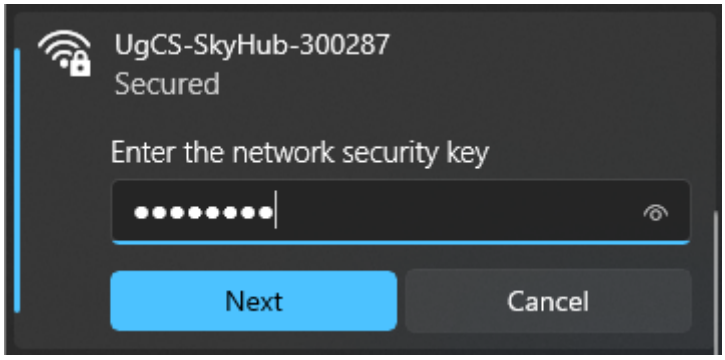



Figure 4.2. Windows Wi-Fi connection dialog. Security key mode.

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.

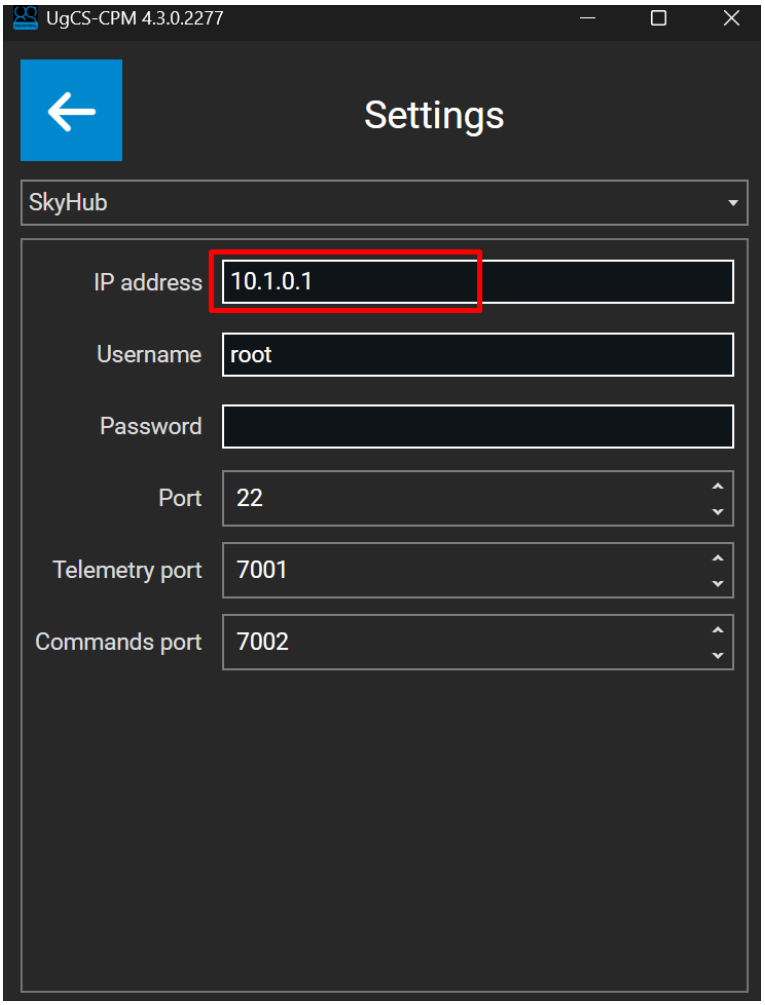



Figure 4.3. Wi-Fi address within UgCS-CPM

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

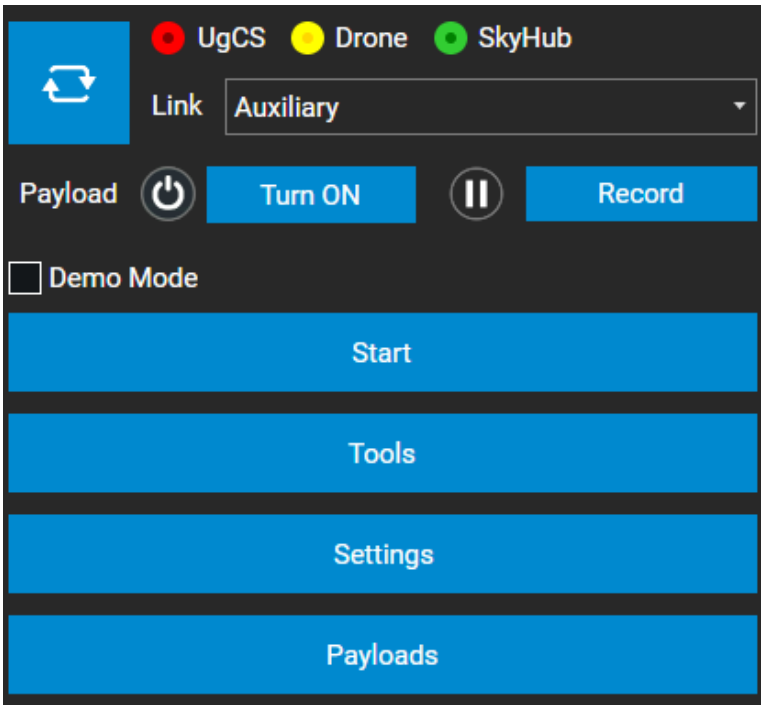



Figure 4.4. Auxiliary link in UgCS-CPM

### 4.1.2 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

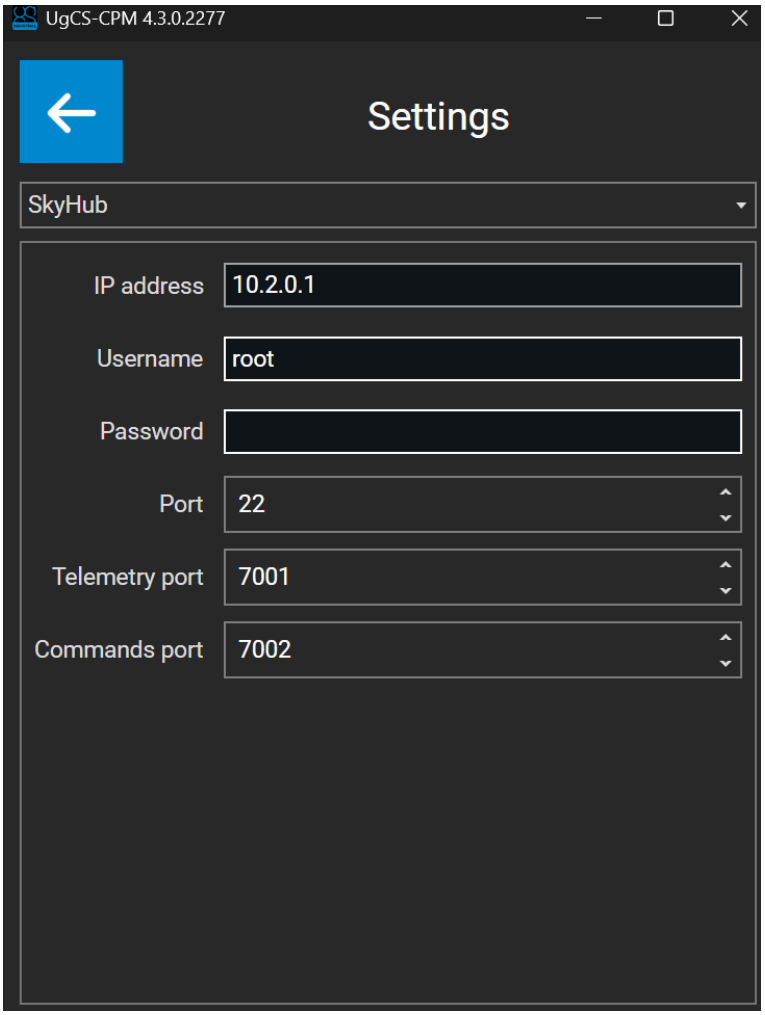



Figure 4.5. Ethernet address within UgCS-CPM

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”.

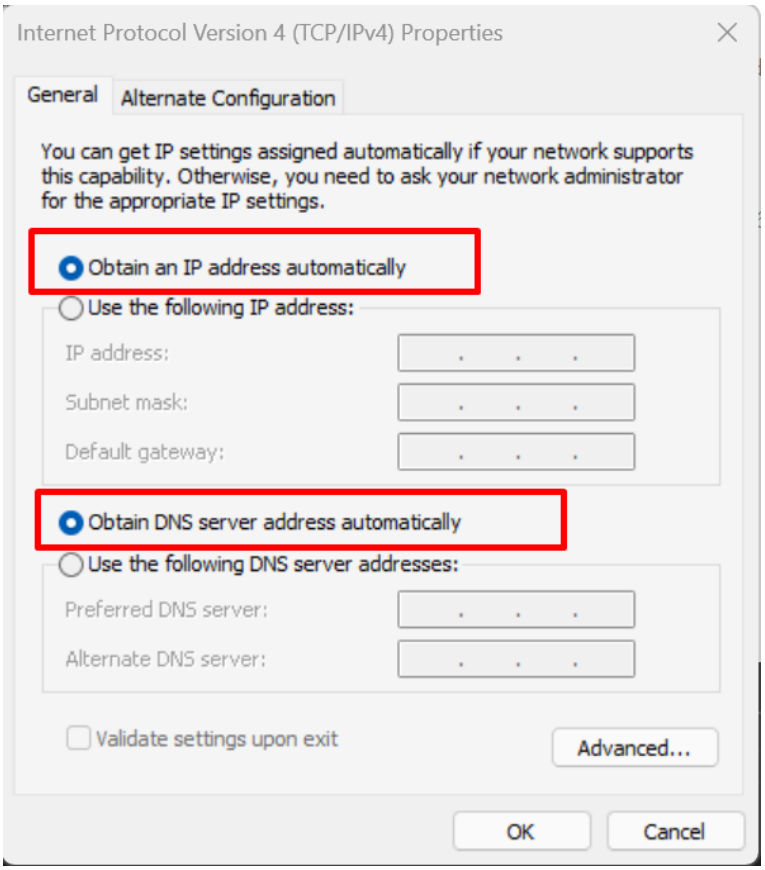



Figure 4.6. Network adapter settings on computer

# 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 PSDK 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 PSDK 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.

## 5.1 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 5.1. 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 M300/M350 RTK

## 6.1 Hardware requirements

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

## 6.2 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**)

## 6.3 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)

## 6.4 Network requirements

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

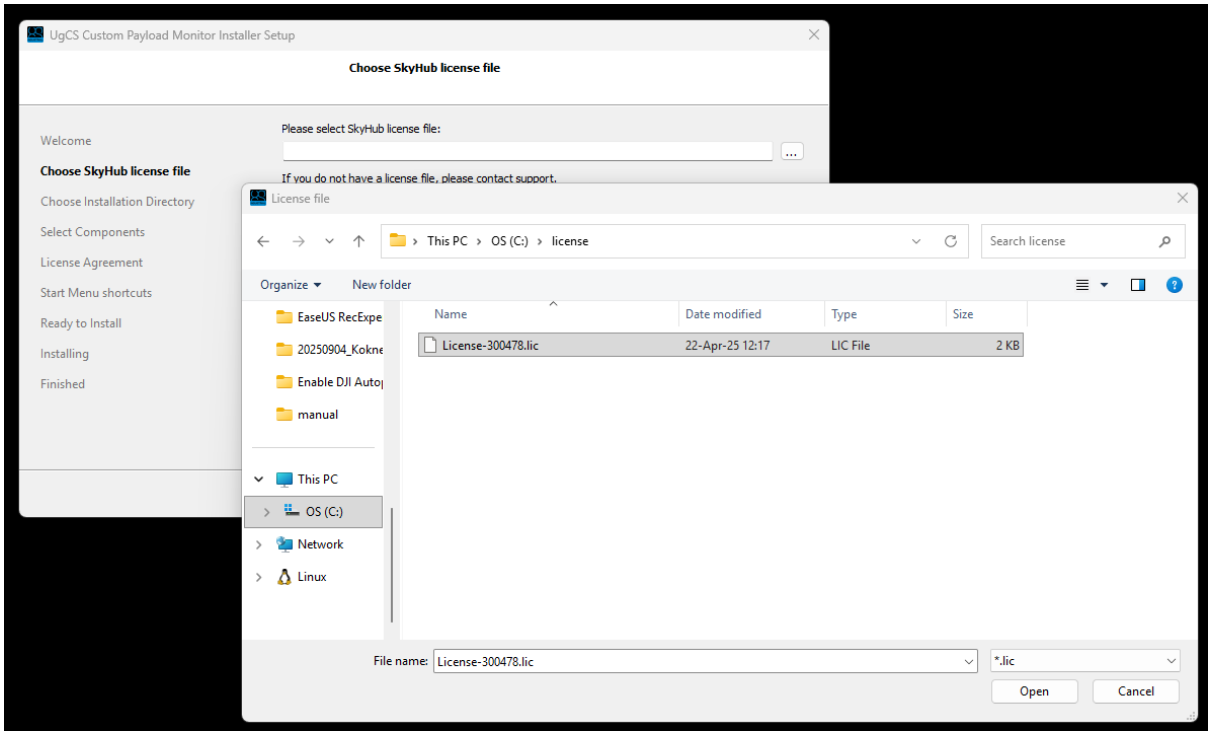
### 6.4.1 UgCS desktop download and setup process

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.

### 6.4.2 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 and provide your SkyHub serial number.

### 6.4.3 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.

## 6.5 Components

SkyHub assembly kit contains the following components:

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


## 6.6 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.


### 6.6.1 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/fMpj5LJpobWeMFi

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.

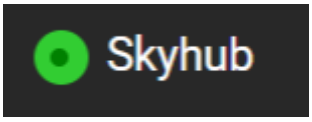
2. Install the sensor on the gimbal of your drone. The mounts should slide in deep enough to be tightly secured on the gimbal, without loose movement.
3. Connect the cable to Connector 1 (yellow) on the SkyHub


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

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

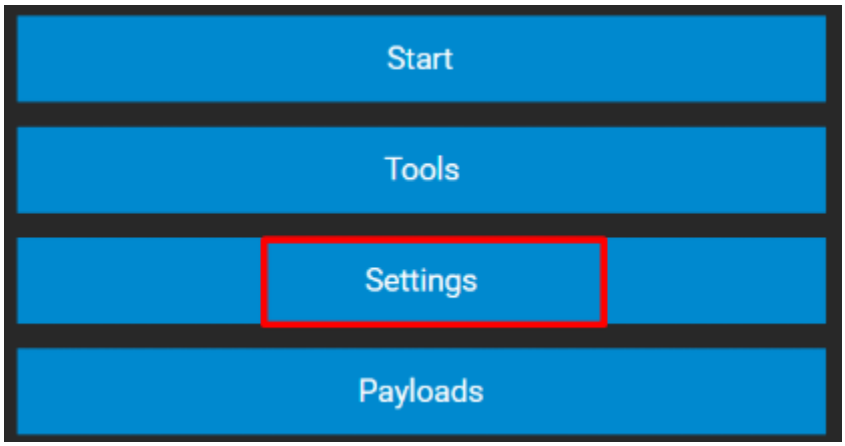
Before proceeding further, power on both the drone and remote controller. Then, make sure that your computer and the controller are connected to the same network. This is required to establish the drone link connection between CPM on your computer and SkyHub on the drone.

**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.

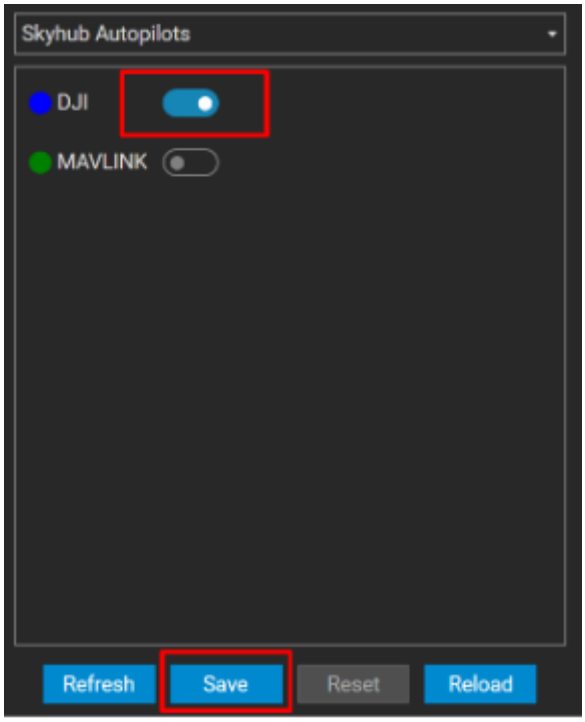



## 6.7 Enabling the autopilot

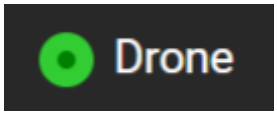
1. Press the Settings button




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



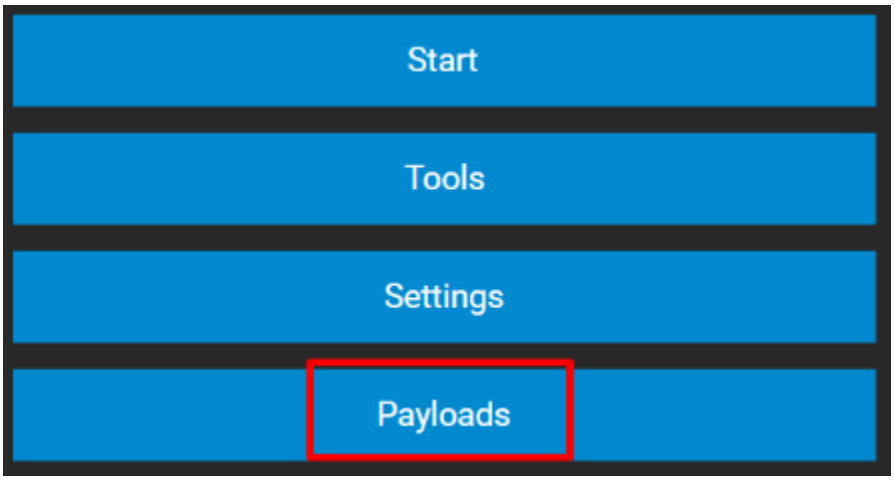

Autopilot configuration is complete. After the system restart, you will notice that the drone link icon should become green.



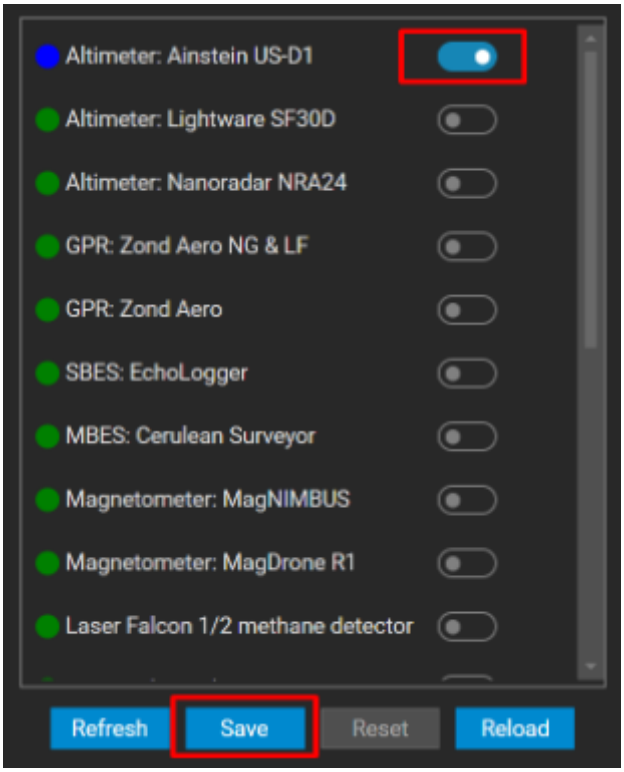
## 6.8 Enabling the altimeter

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

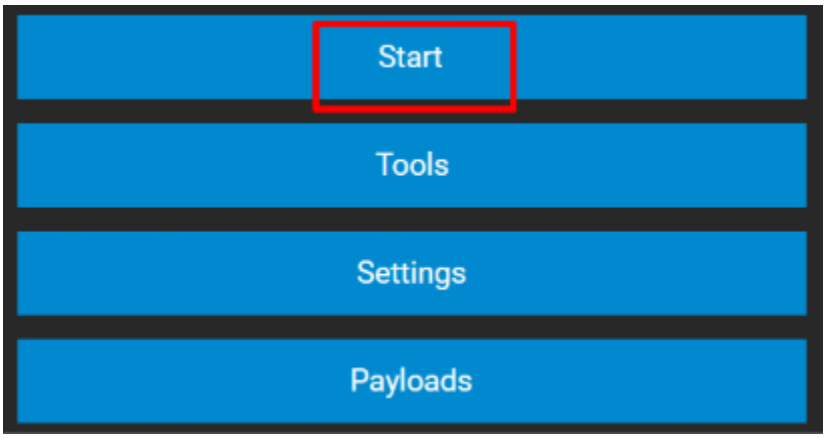
1. Click on the Payloads section




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.

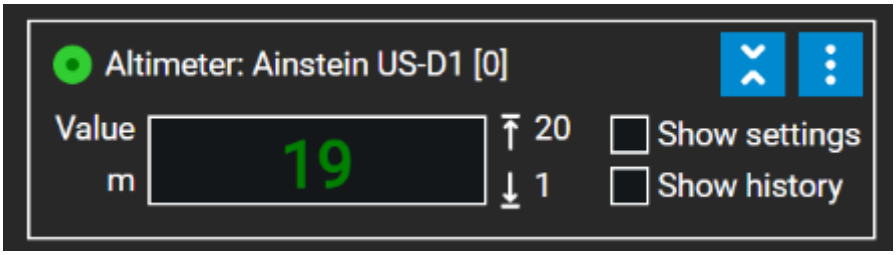



3. After the restart is complete, press the Start button.




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: ArduPilot

## 7.1 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).

## 7.2 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.

### 7.2.1 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.

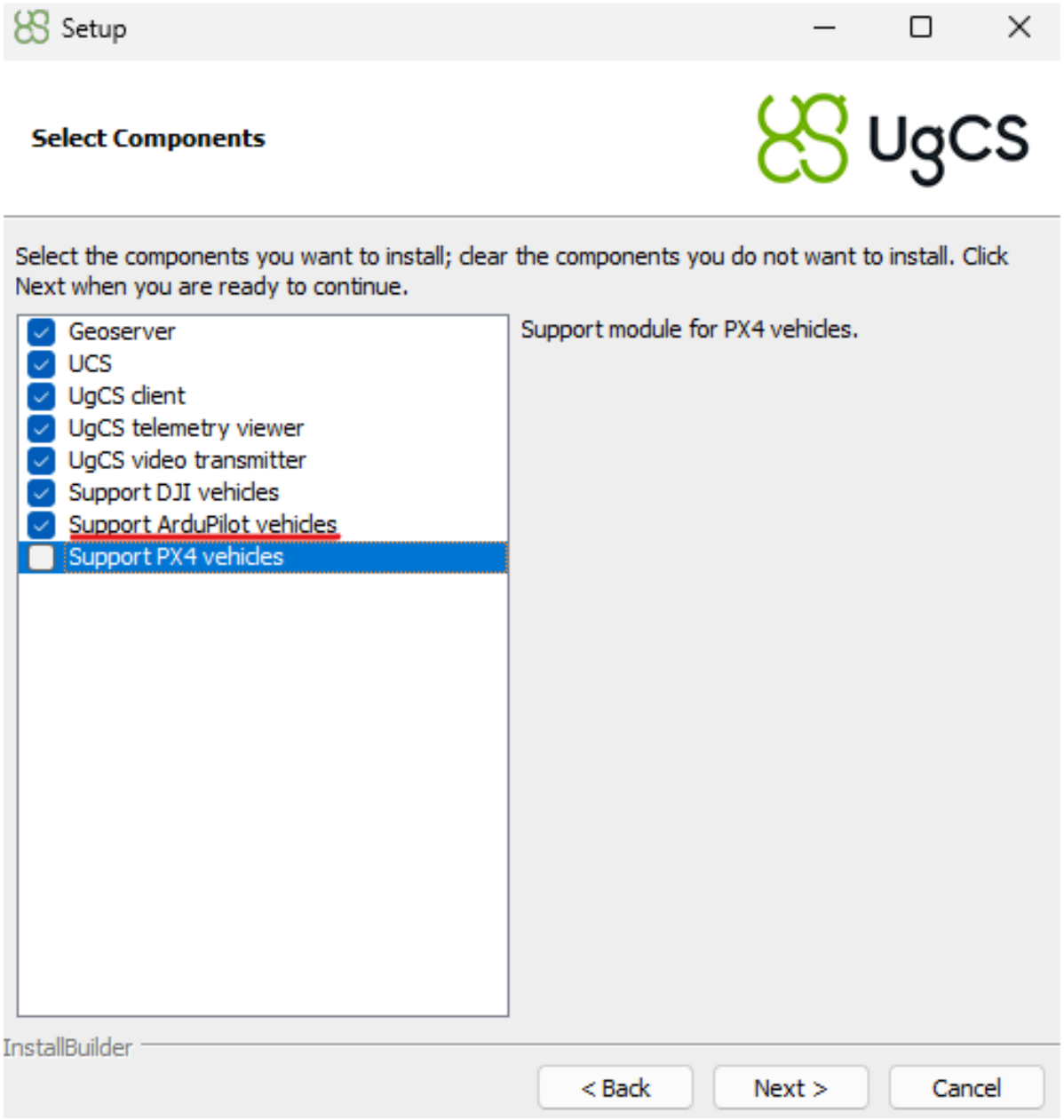
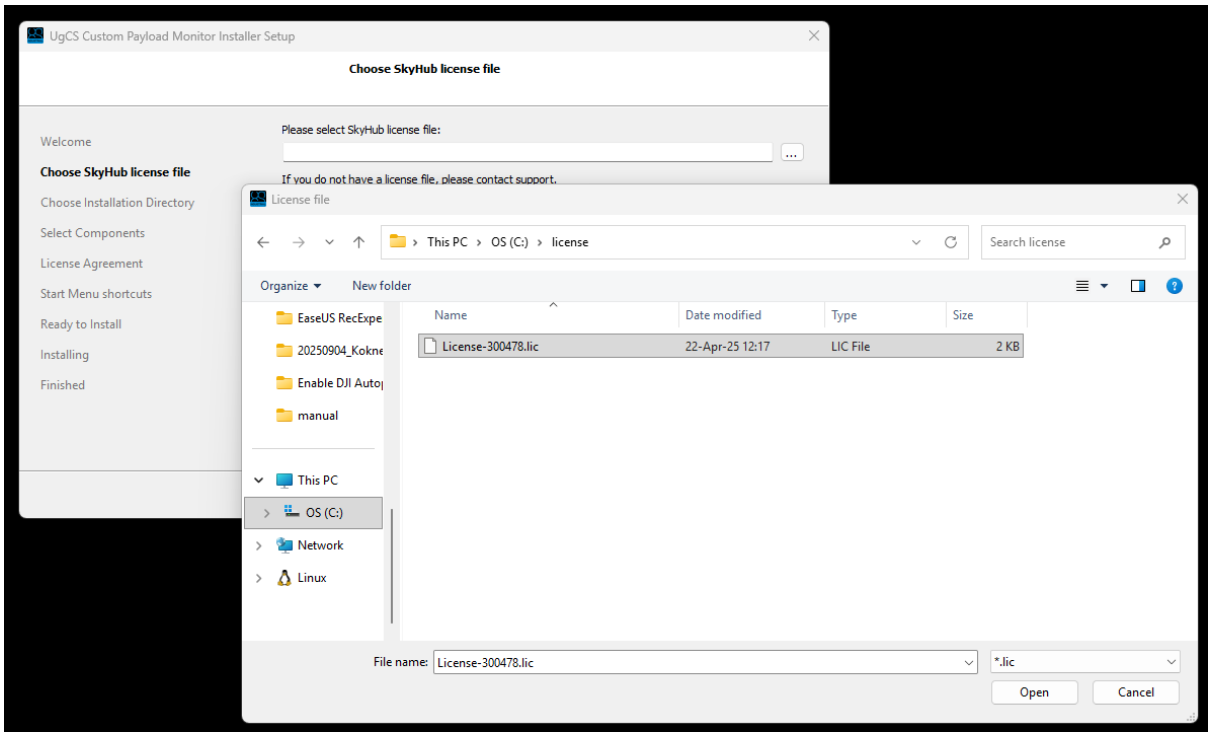



Figure 7.1. ArduPilot compatibility in UgCS setup

5. Installation complete.

### 7.2.2 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 and provide your SkyHub serial number.

### 7.2.3 SkyHub installation on the drone

## 7.3 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.

## 7.4 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.

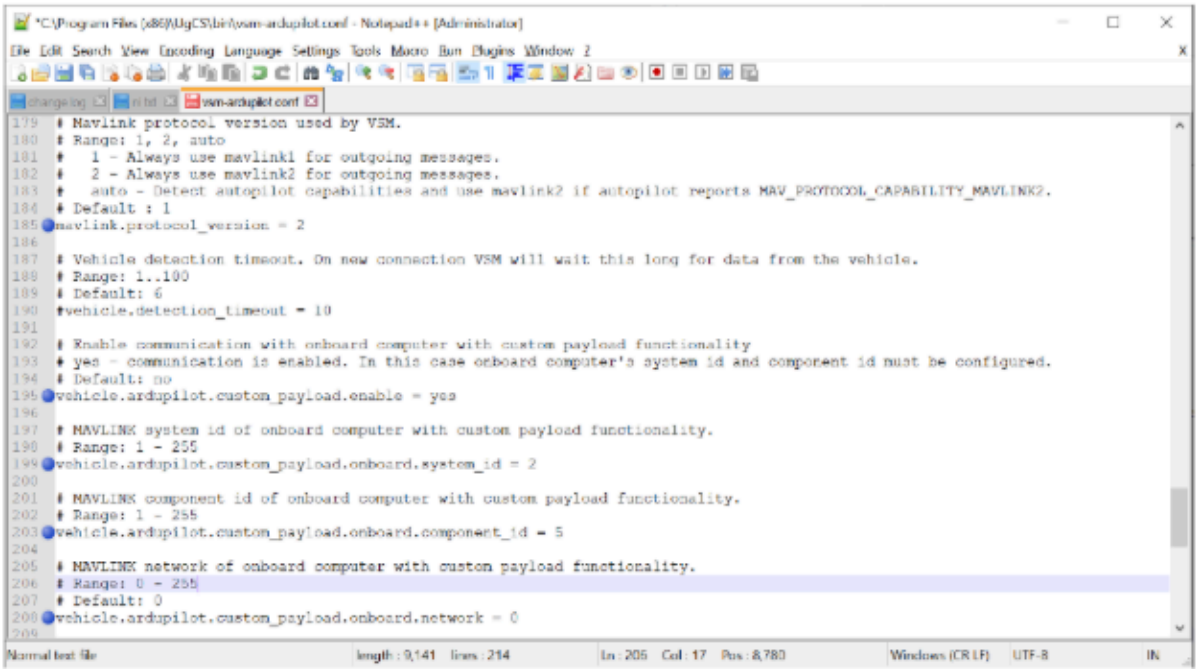



Figure 7.2. ArduPilot VSM configuration

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.

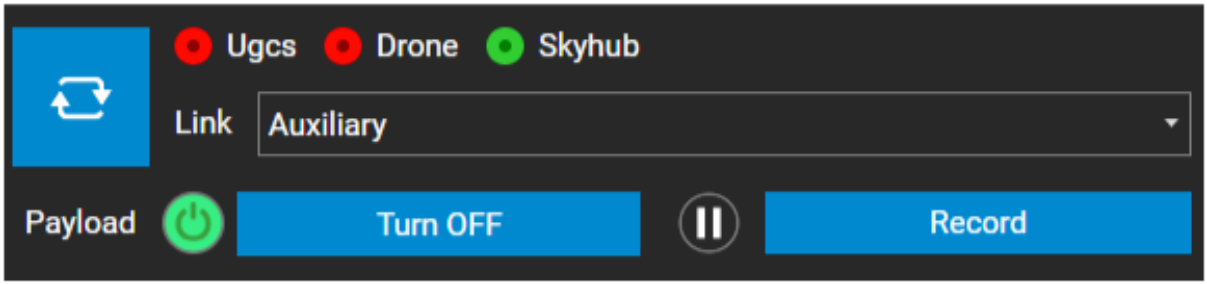



Figure 7.3. Auxiliary Link settings in UgCS-CPM

**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.

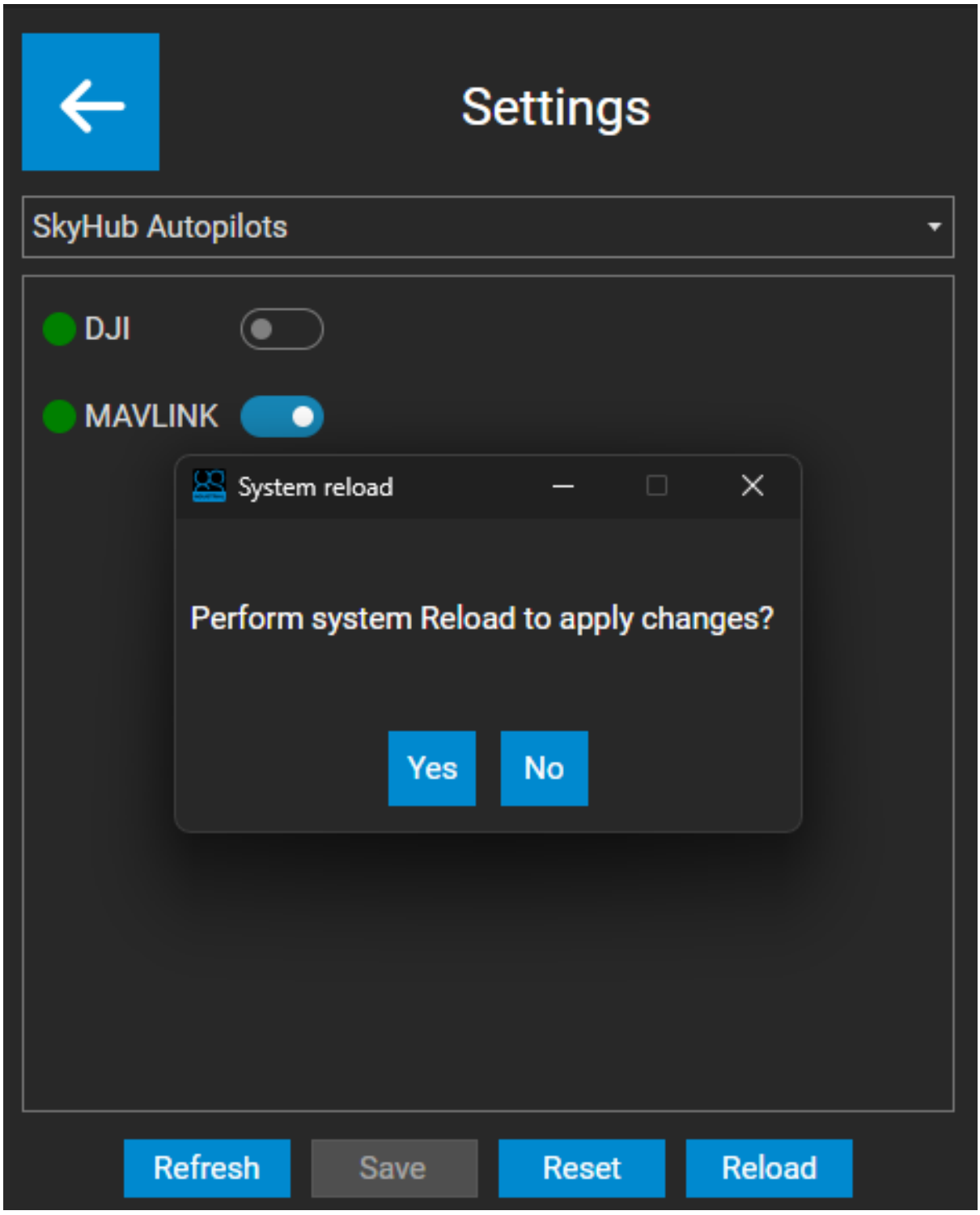



Figure 7.4. Enabling MAVlink in UgCS-CPM

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.

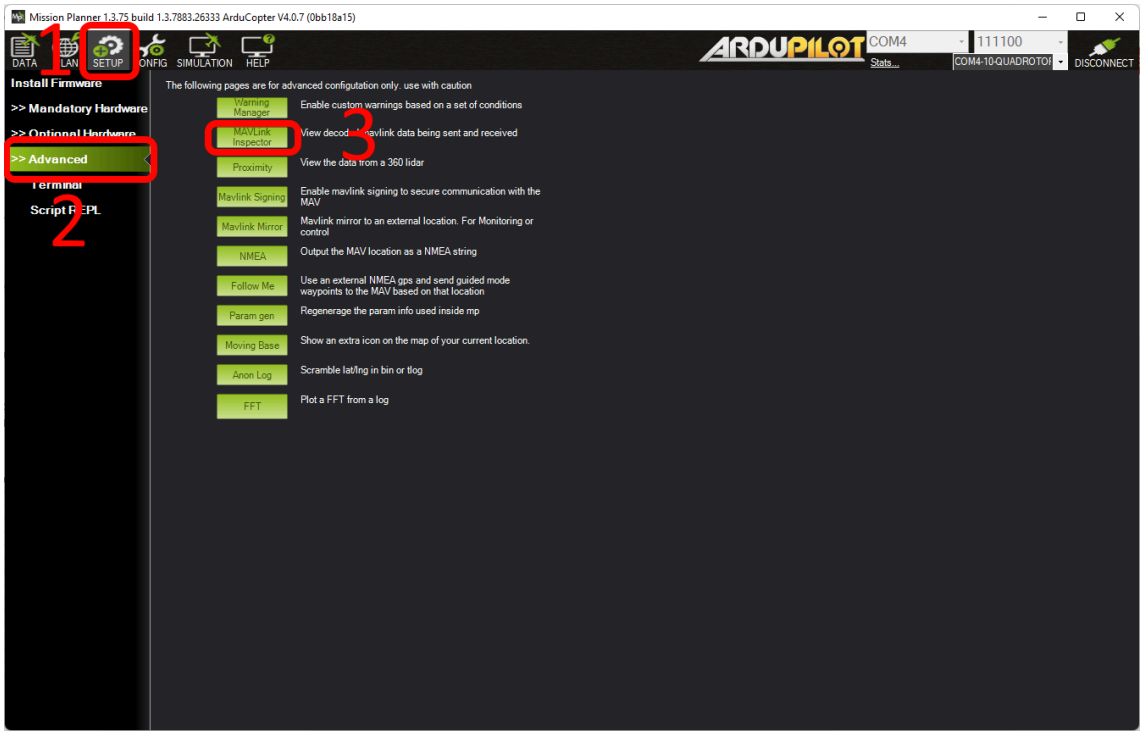



Figure 7.5. Mission Planner MAVlink inspector

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

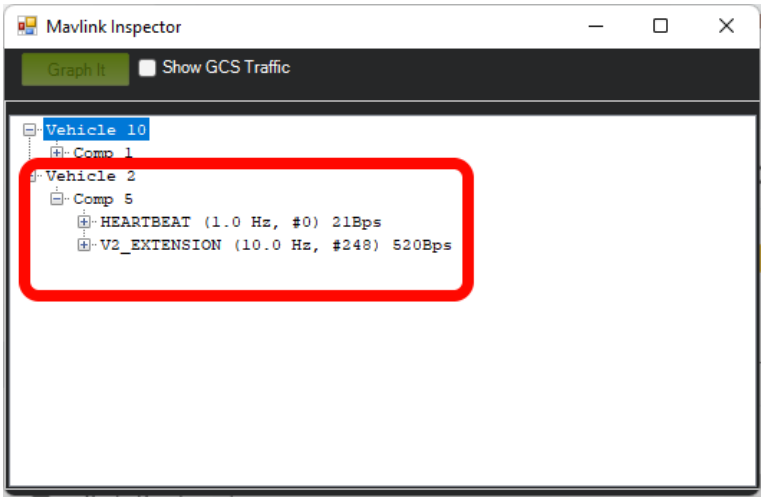



Figure 7.6. Mission Planner MAVlink inspector data

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.

# Quick Start: PX4

**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.

## 8.1 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).

## 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**)
- QGroundControl for the PX4 configuration.
- WinSCP (optional) to access SkyHub file system for advanced configuration.

### 8.2.1 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.

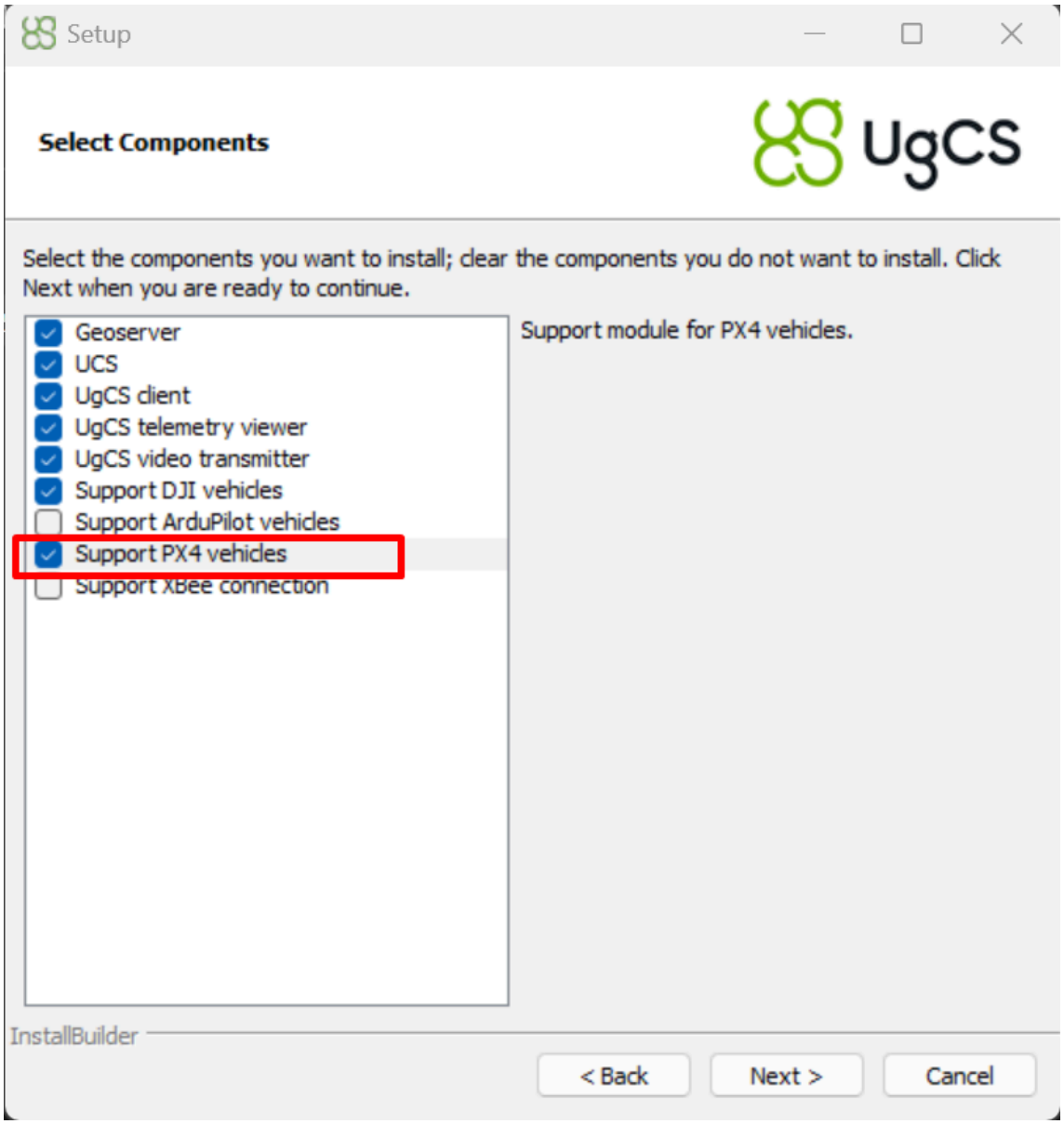
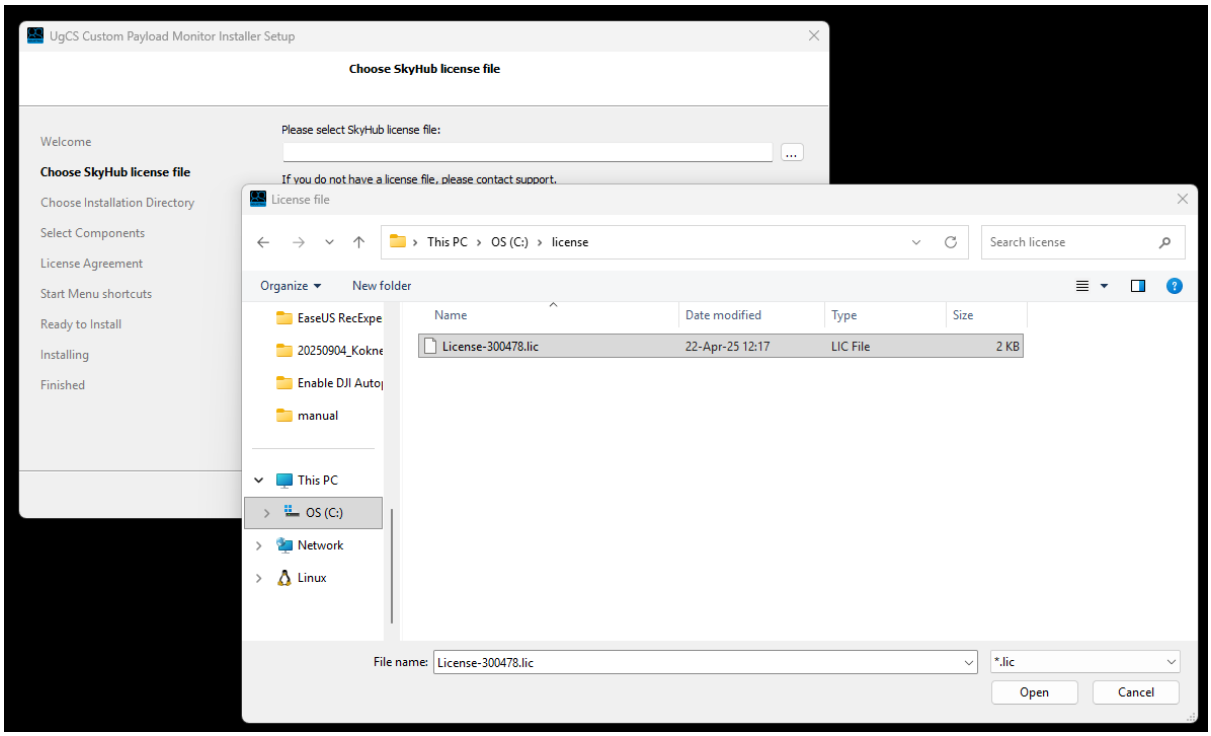



Figure 8.1. PX4 VSM in UgCS setup

5. Installation complete.

### 8.2.2 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 and provide your SkyHub serial number.

### 8.2.3 SkyHub installation on the drone

## 8.3 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.

## 8.4 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.

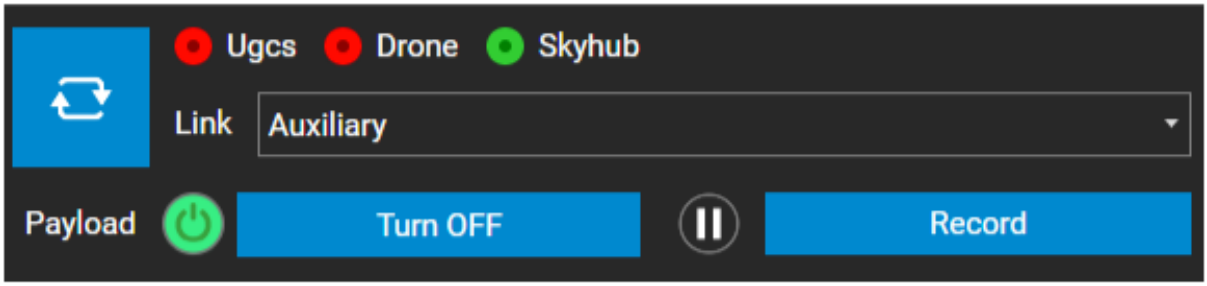



Figure 8.2. Auxiliary Link settings in UgCS-CPM

---

**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.

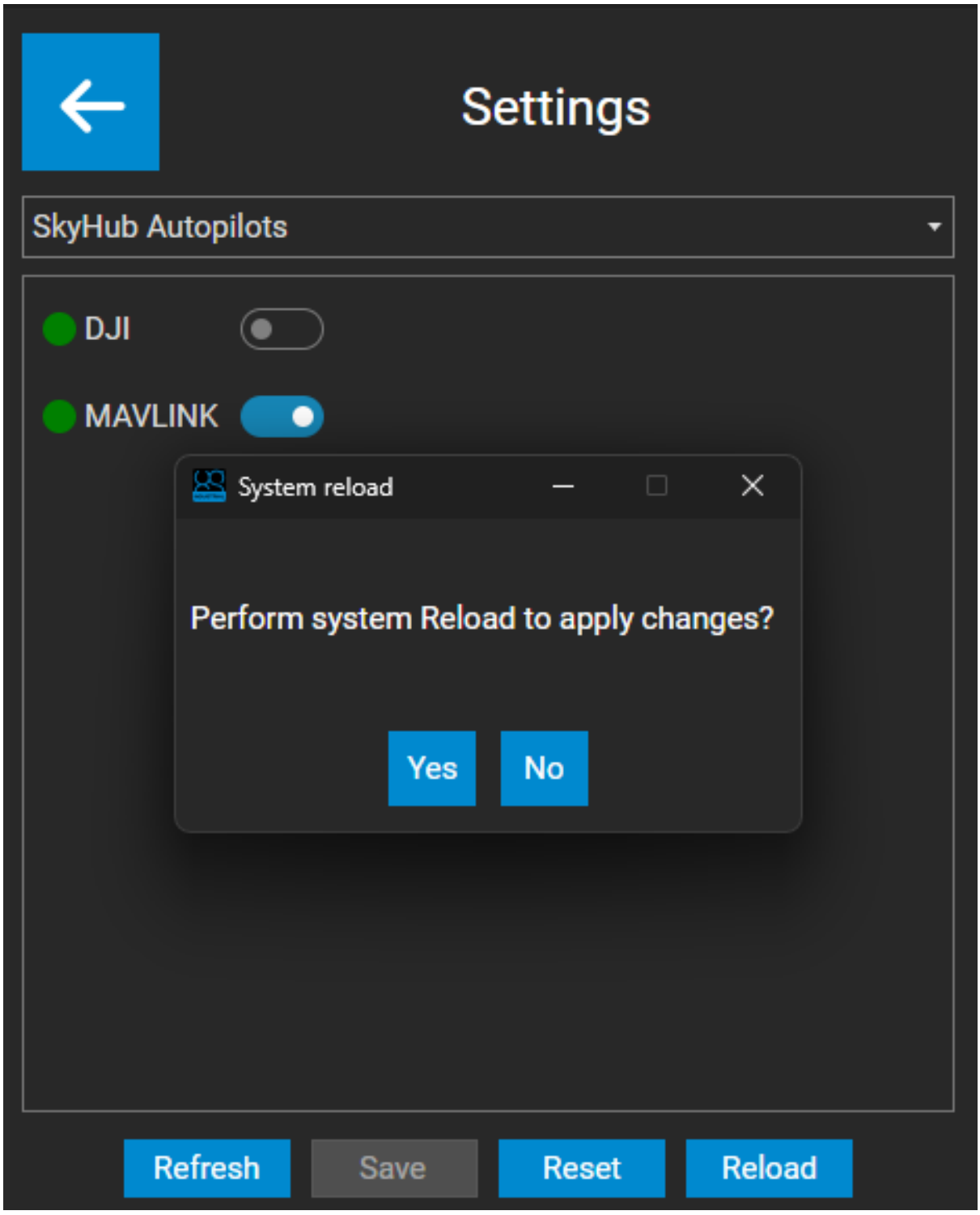



Figure 8.3. Enabling MAVlink in UgCS-CPM

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.

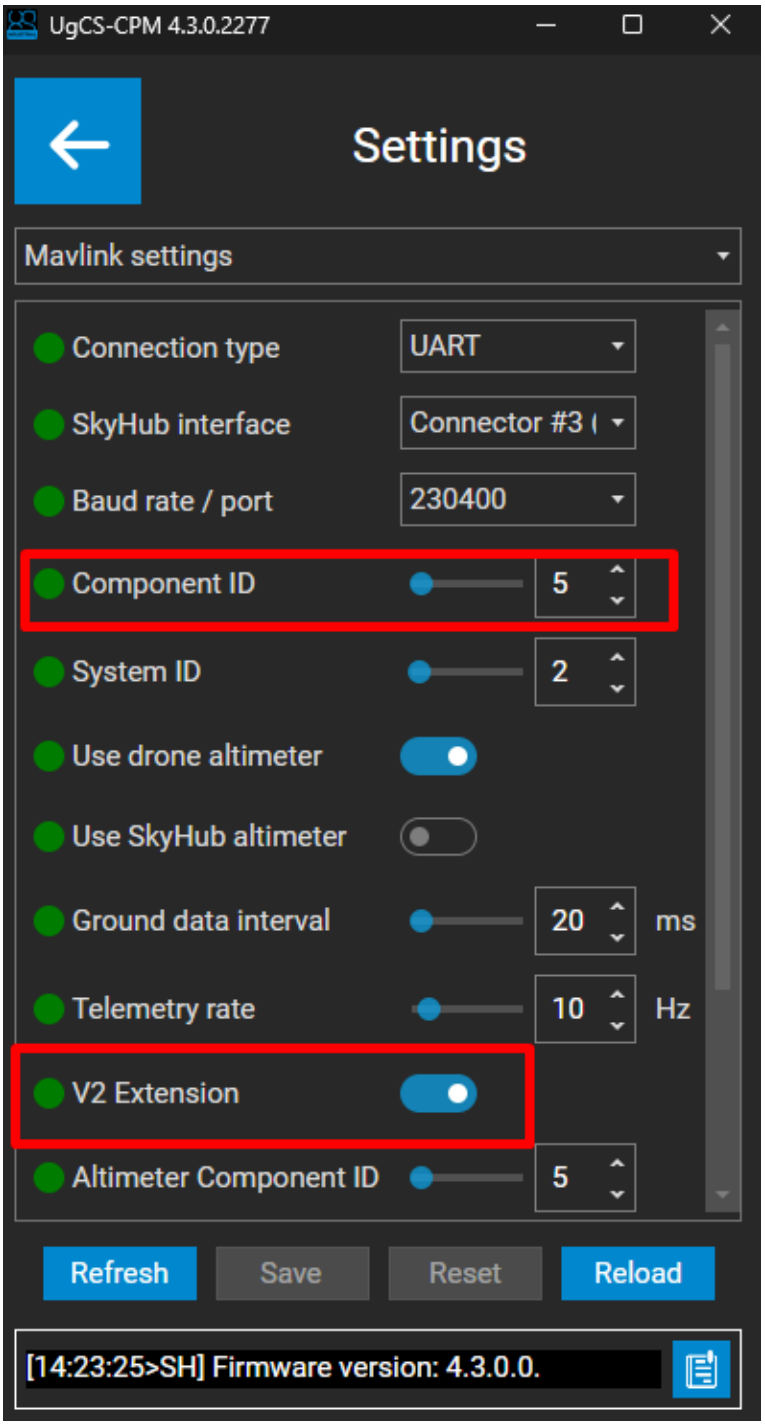



Figure 8.4. MAVLINK settings

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`.

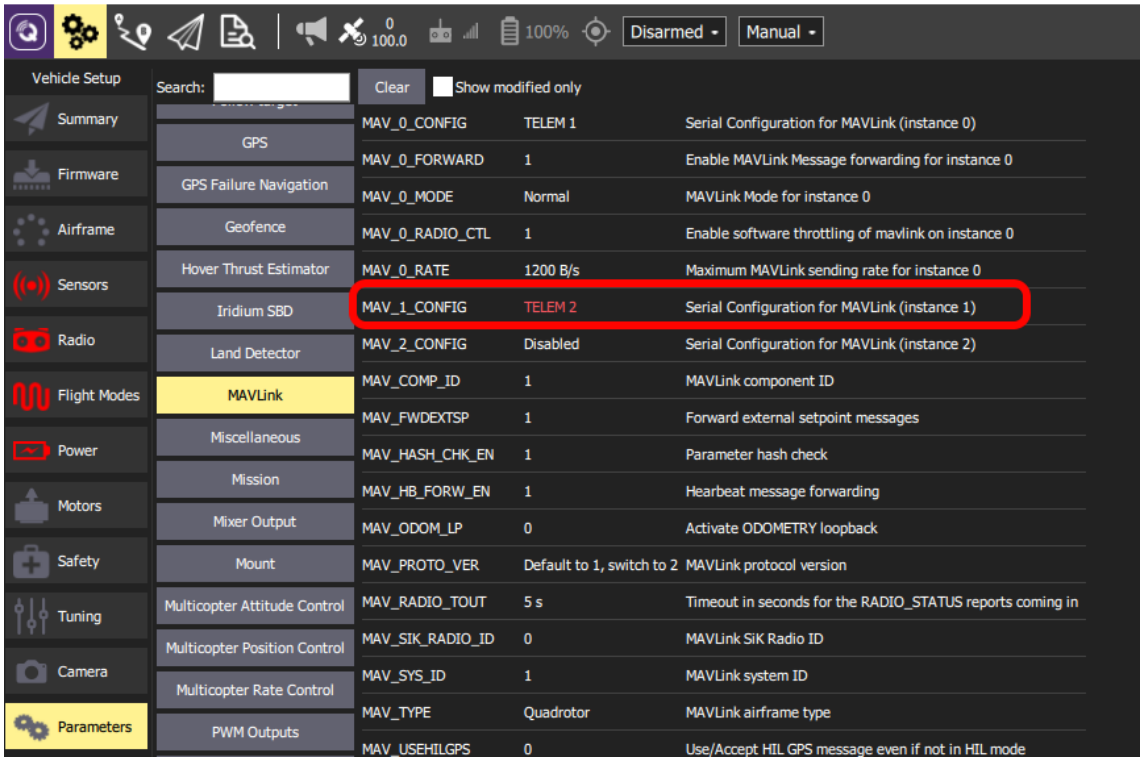



Figure 8.5. SkyHub PX4 TELEM2 port configuration

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`.

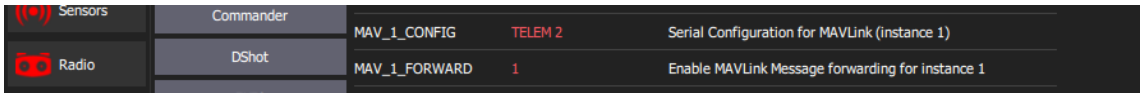



Figure 8.6. SkyHub PX4 TELEM2 port data forwarding configuration

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.

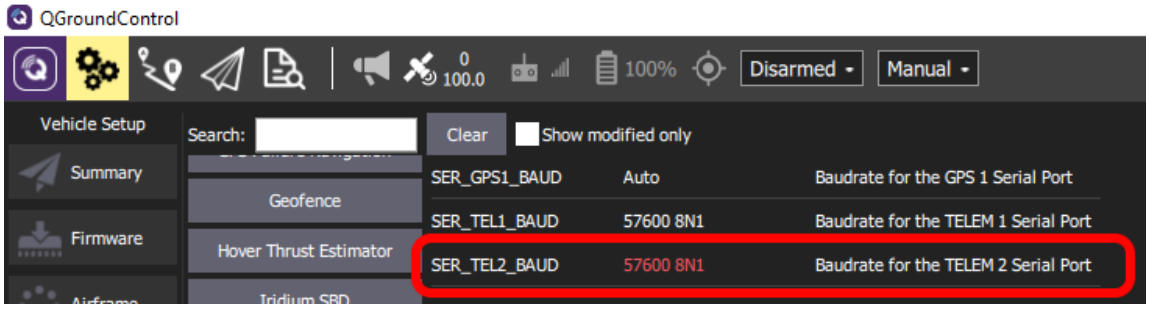



Figure 8.7. SkyHub PX4 TELEM2 port baudrate configuration

**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

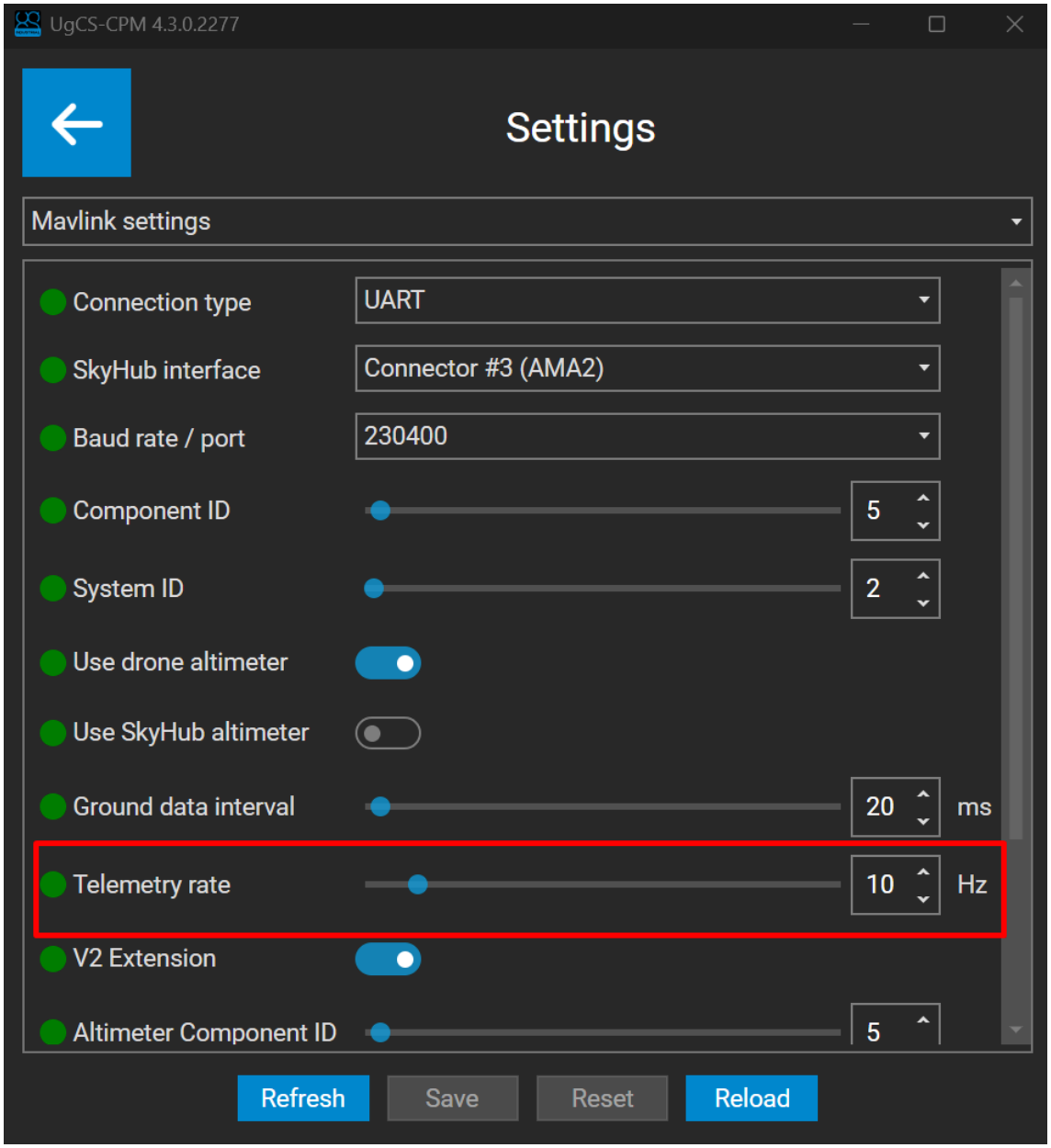


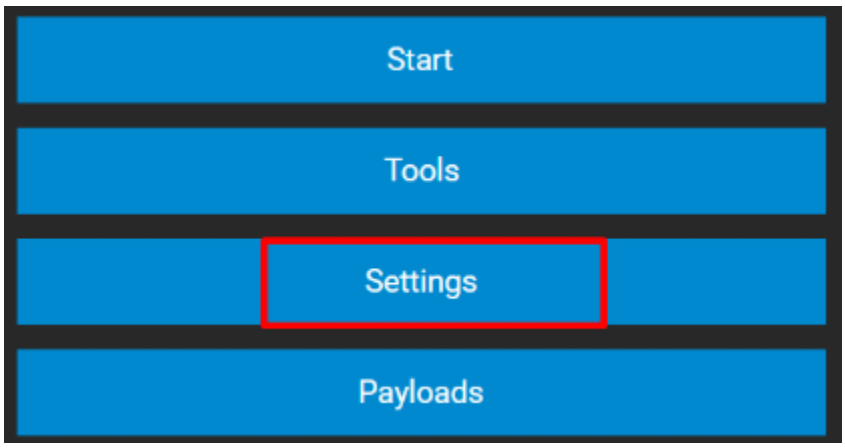

Figure 8.8. Mavlink  telemetry rate

# Setup Interface to DJI Autopilot M300 / M350

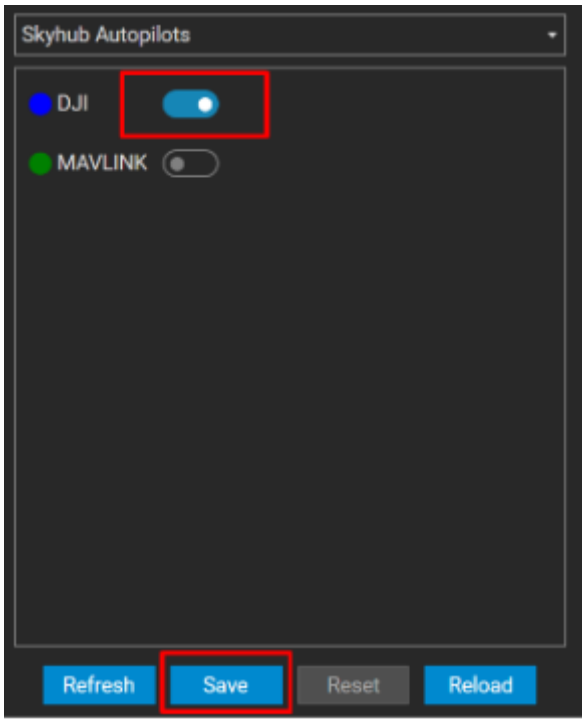
**Note** Before the autopilot configuration, Auxiliary or drone link connection must be established between the remote controller and UgCS-CPM software on your computer.

## 9.1 Enabling the autopilot

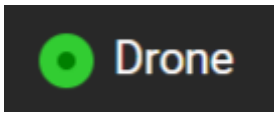
1. Press the Settings button.




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.




## 9.2 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.

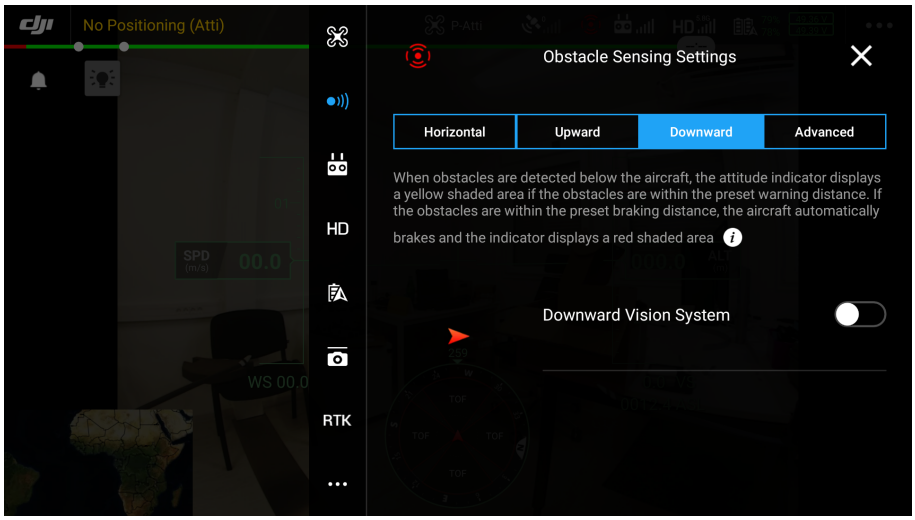



Figure 9.1. M300 / M350 RTK DJI Pilot screens

## 9.3 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.

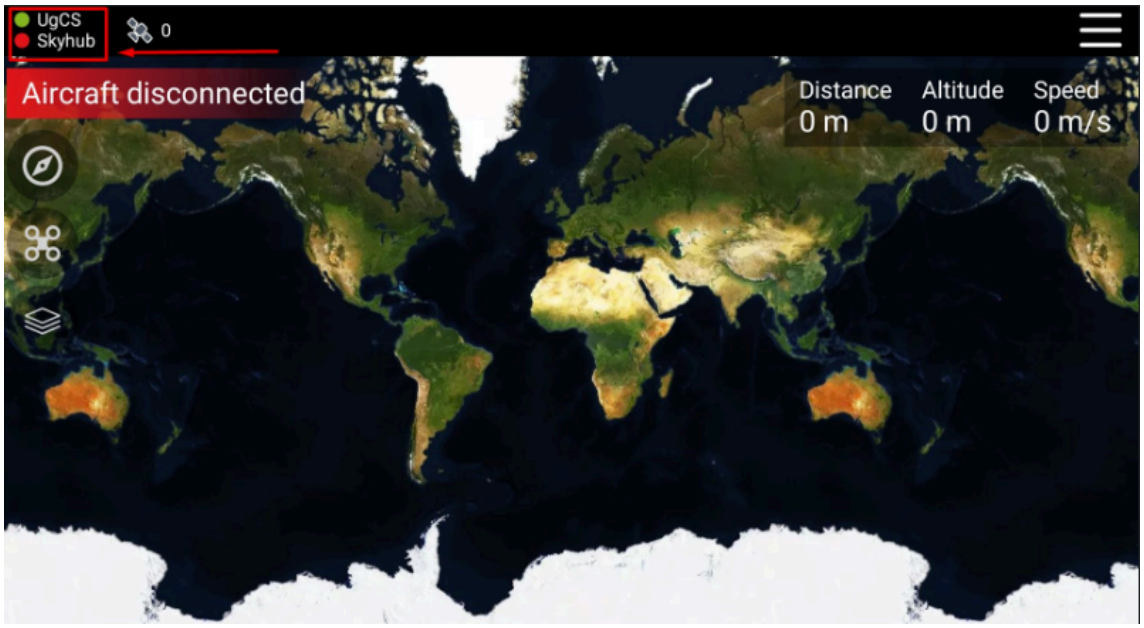



Figure 9.2. UgCS Companion server selection button

**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 9.3. 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.

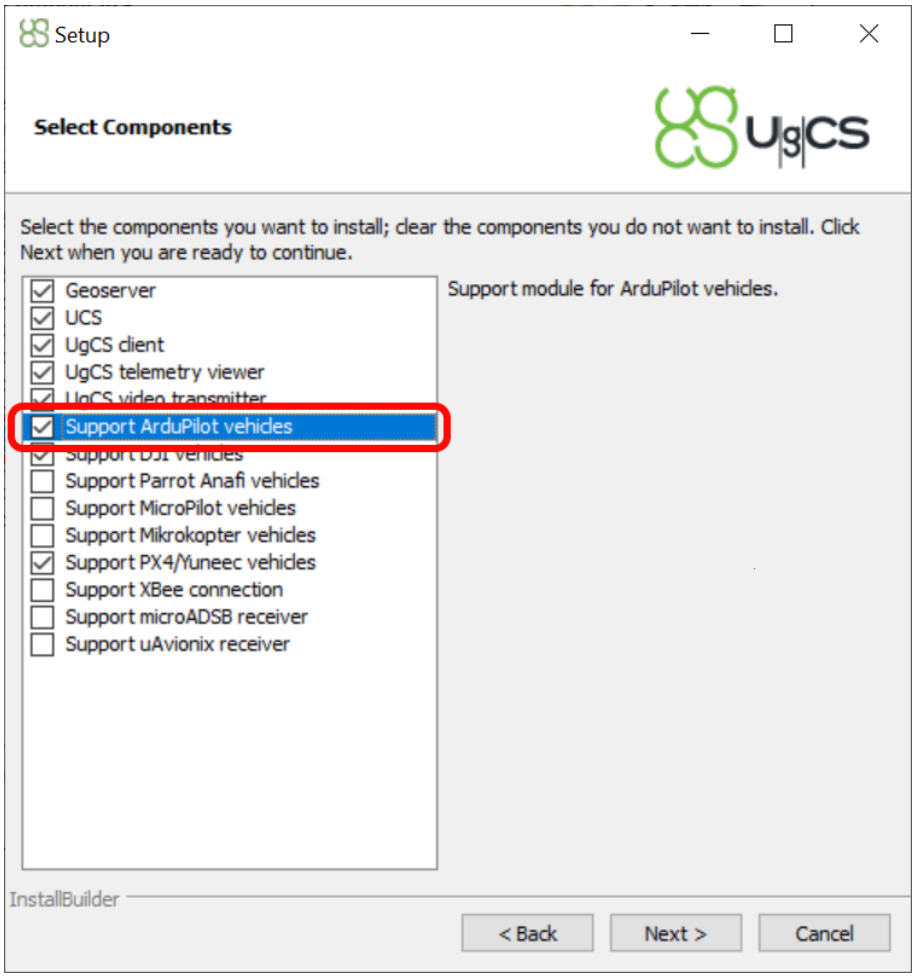



Figure 10.1. UgCS installation Support for ArduPilot vehicles

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.

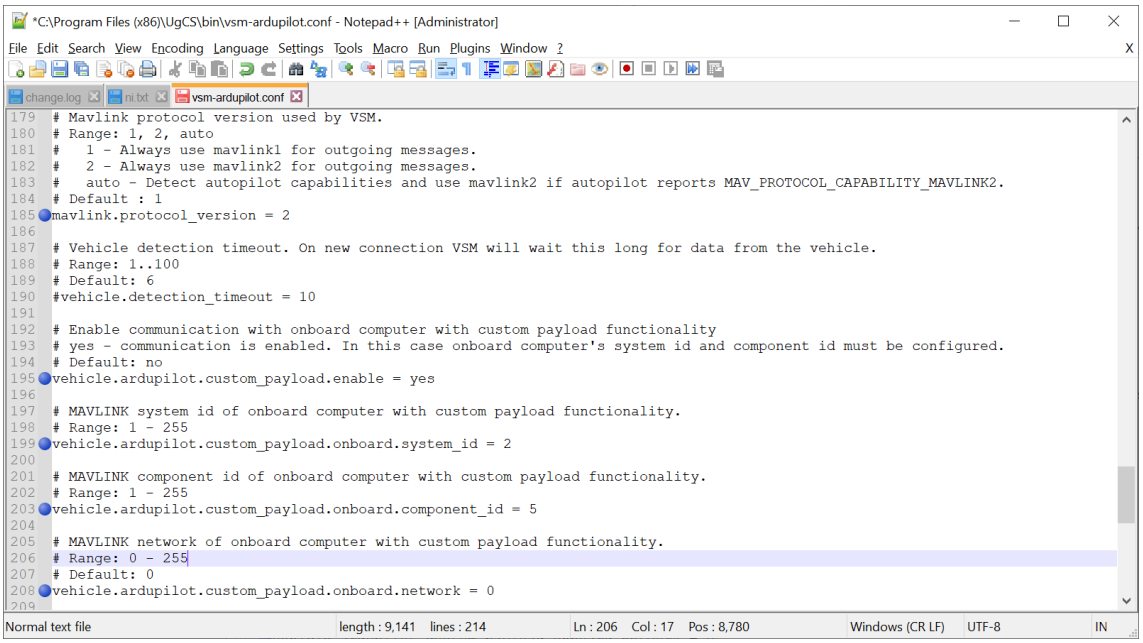



Figure 10.2. ArduPilot VSM configuration file

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.

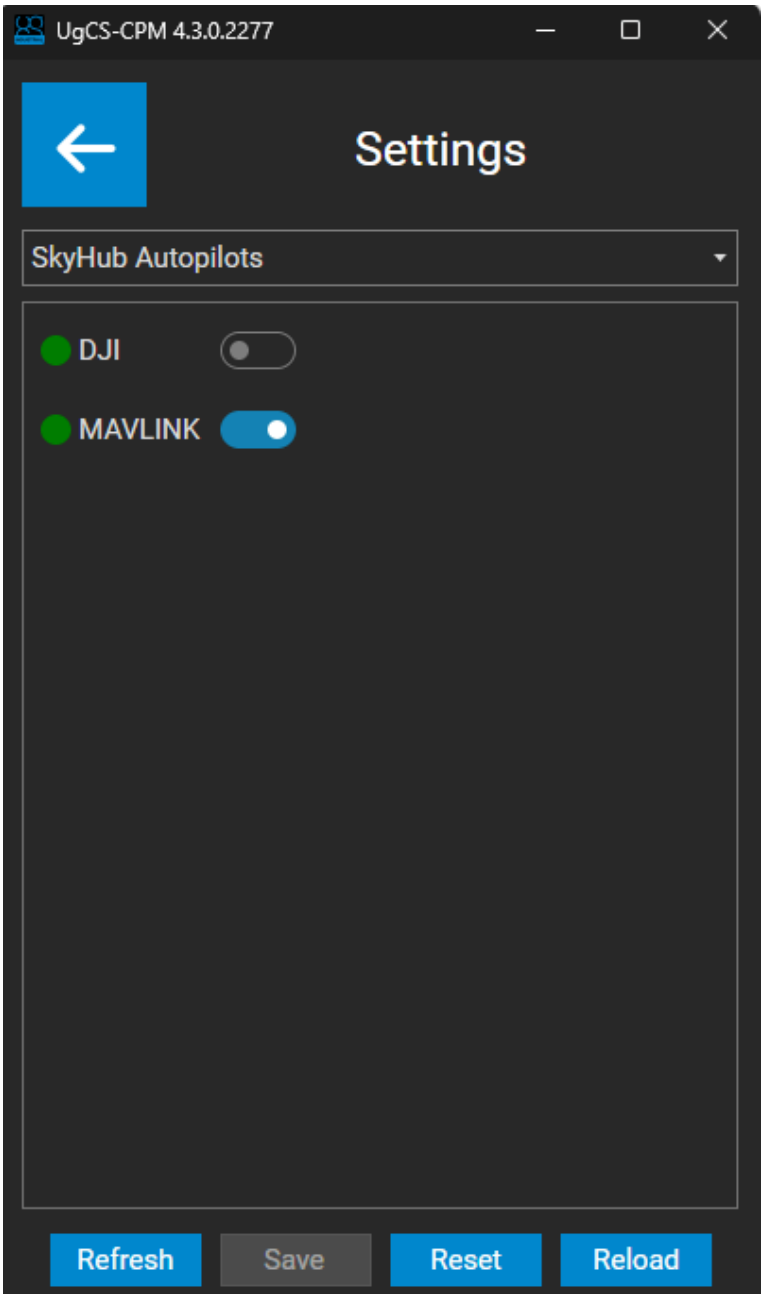



Figure 10.3. MAVLINK autopilot

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.

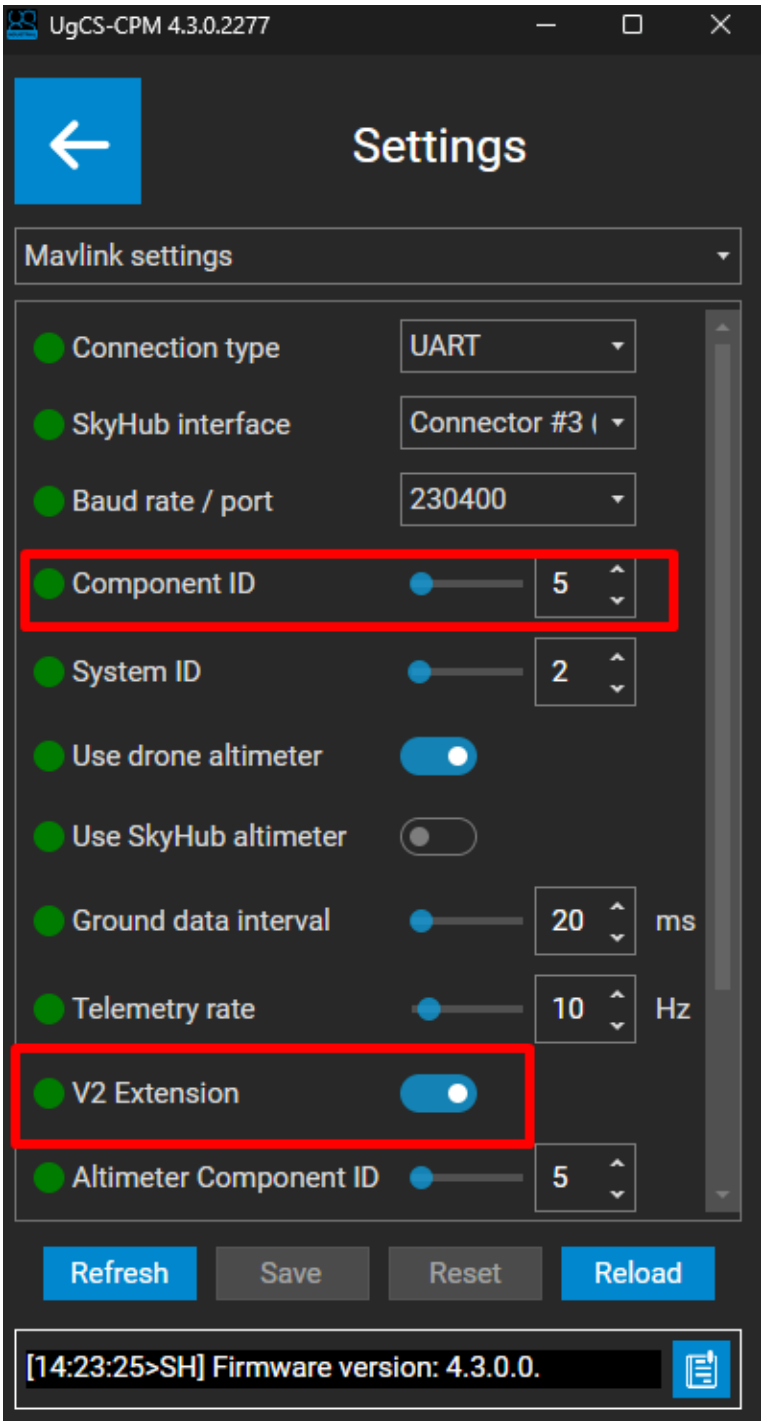



Figure 10.4. MAVLINK settings

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.

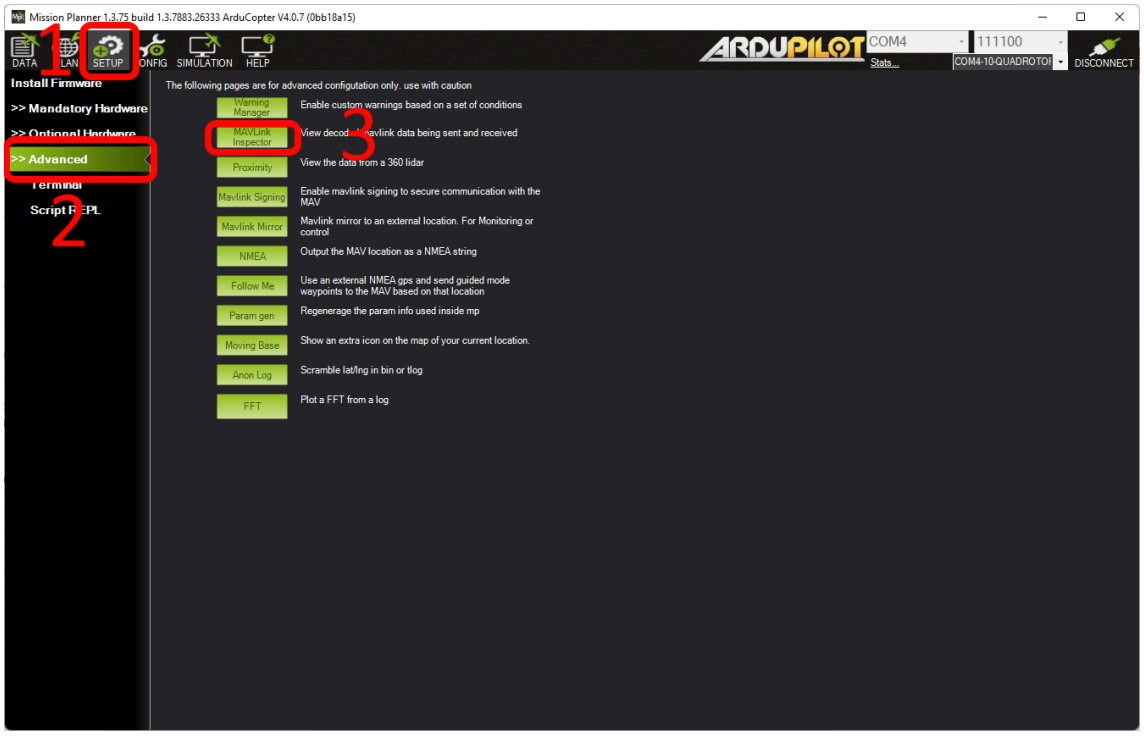



Figure 10.5. Mission Planner MAVlink inspector

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

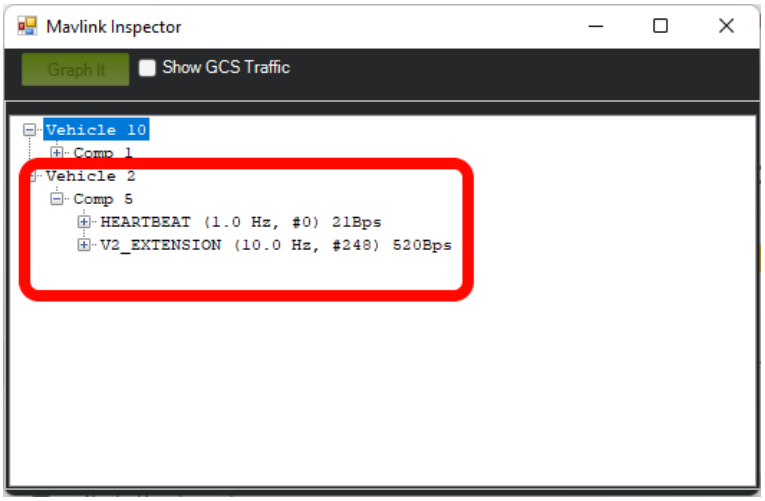



Figure 10.6. Mission Planner MAVlink inspector data

**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.

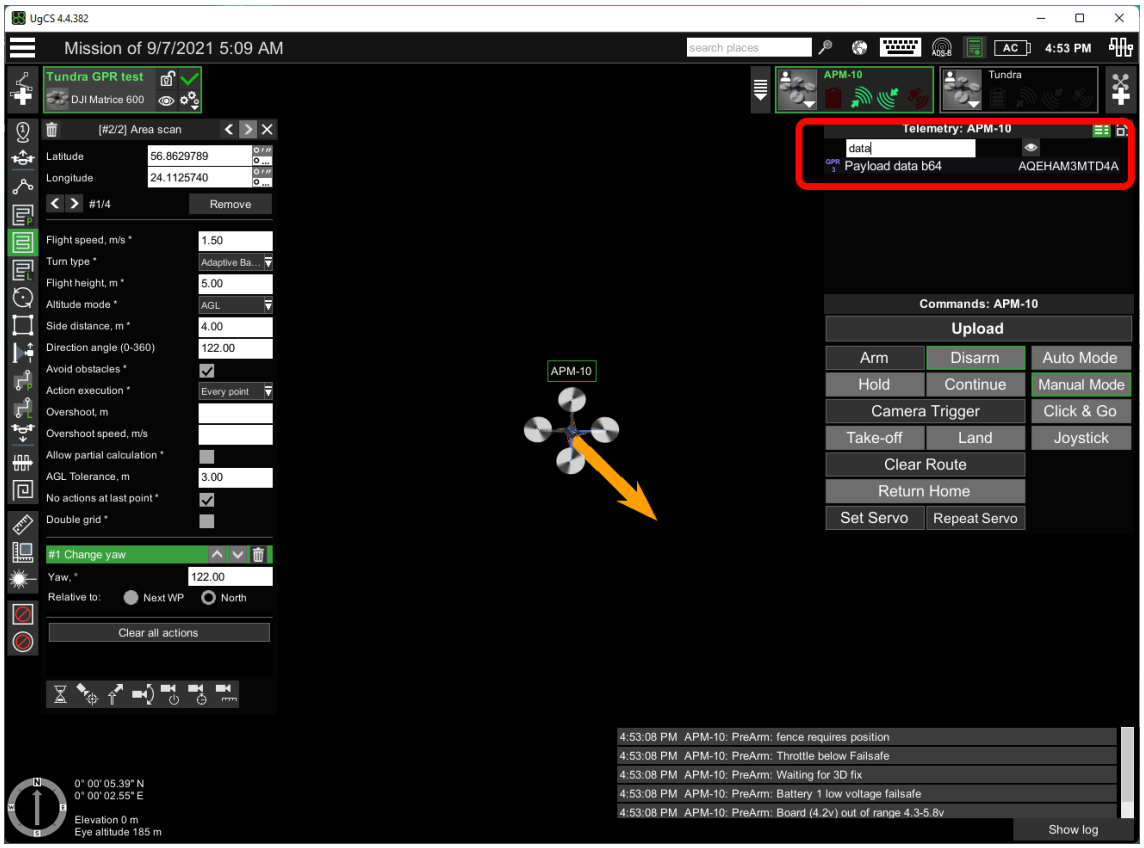



Figure 10.7. UgCS, drone telemetry

# 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.

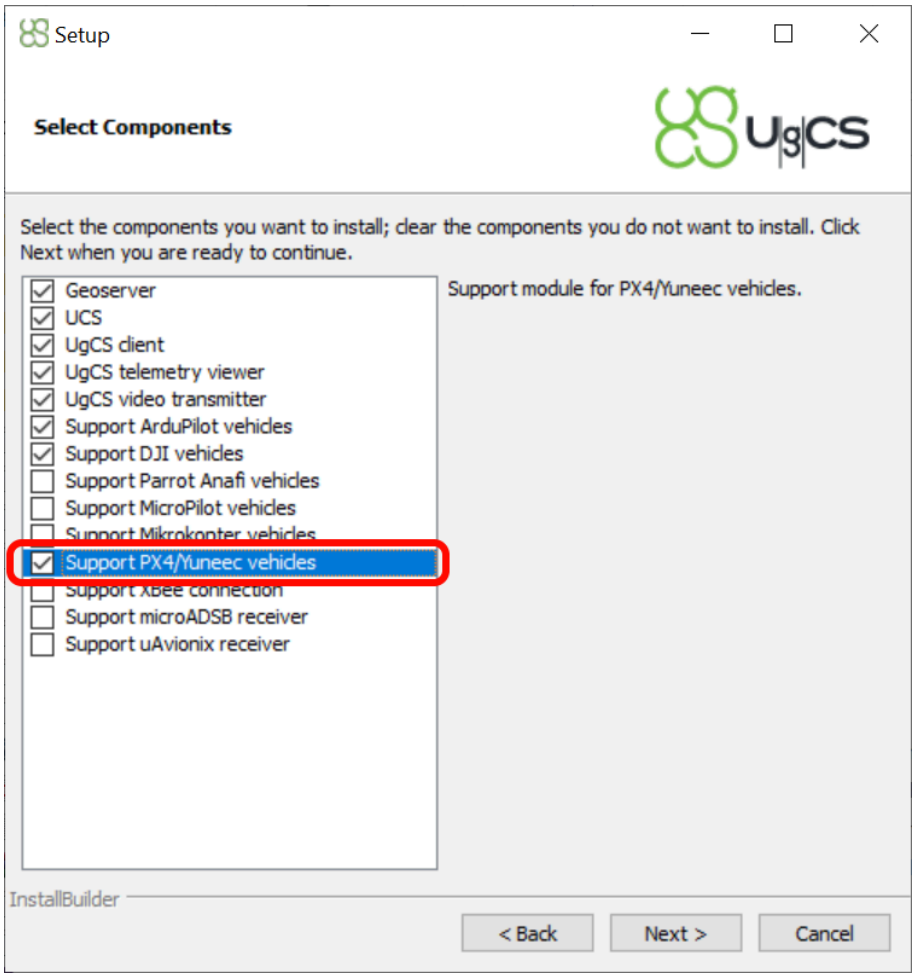



Figure 11.1. UgCS installation Support for PX4 based vehicles

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.

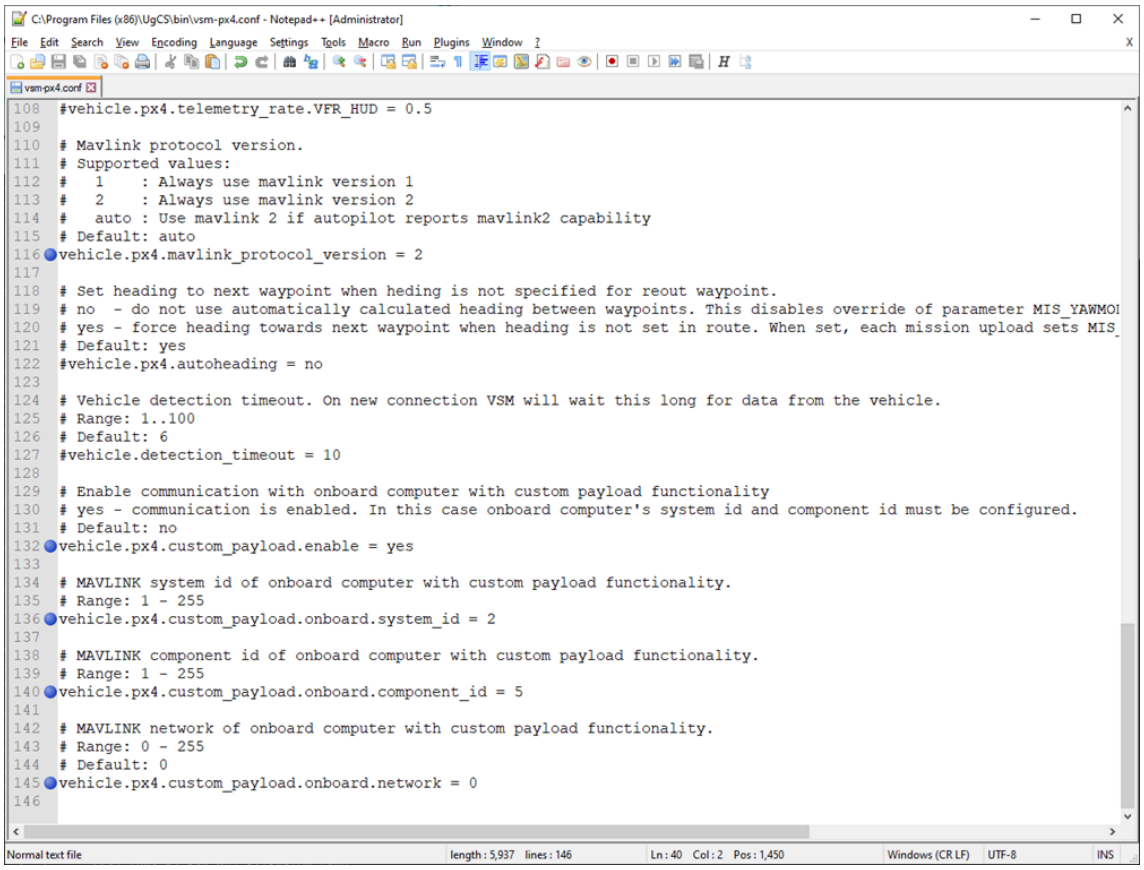



Figure 11.2. PX4 VSM configuration file

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.

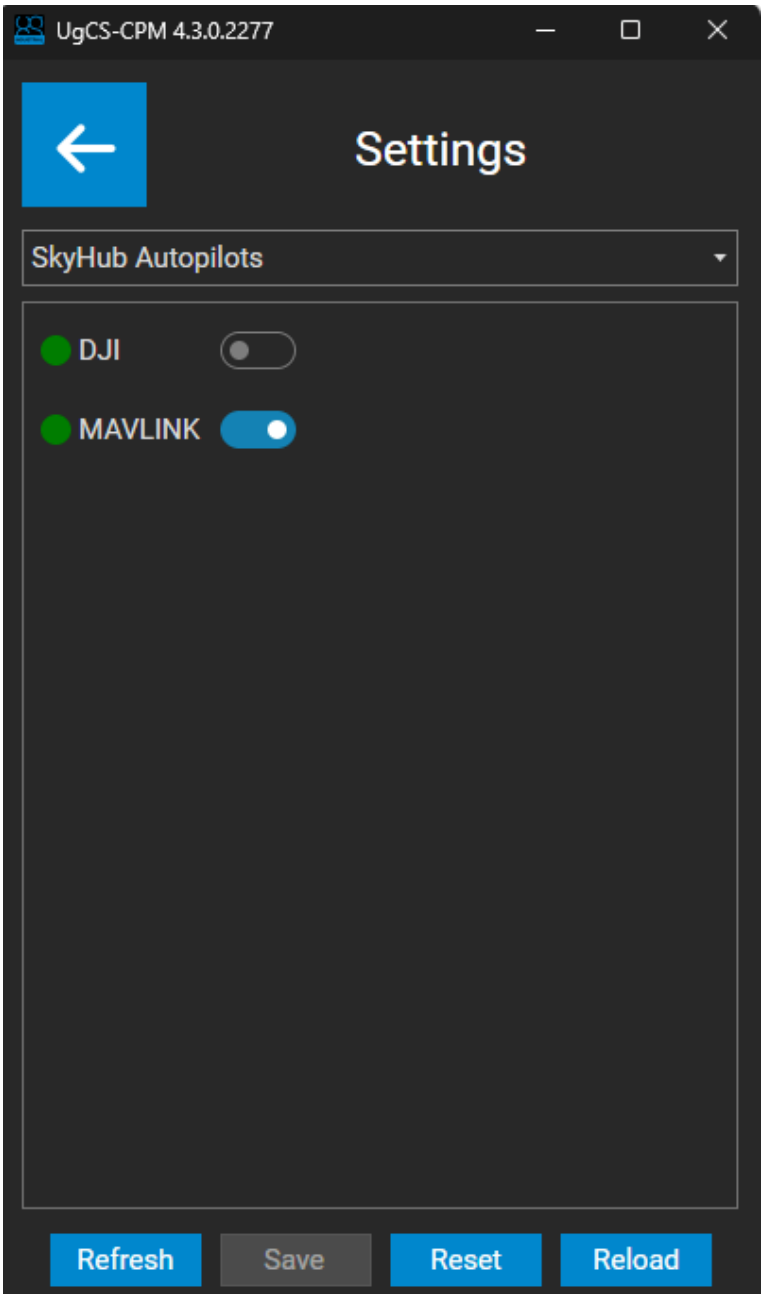



Figure 11.3. MAVLINK autopilot

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.

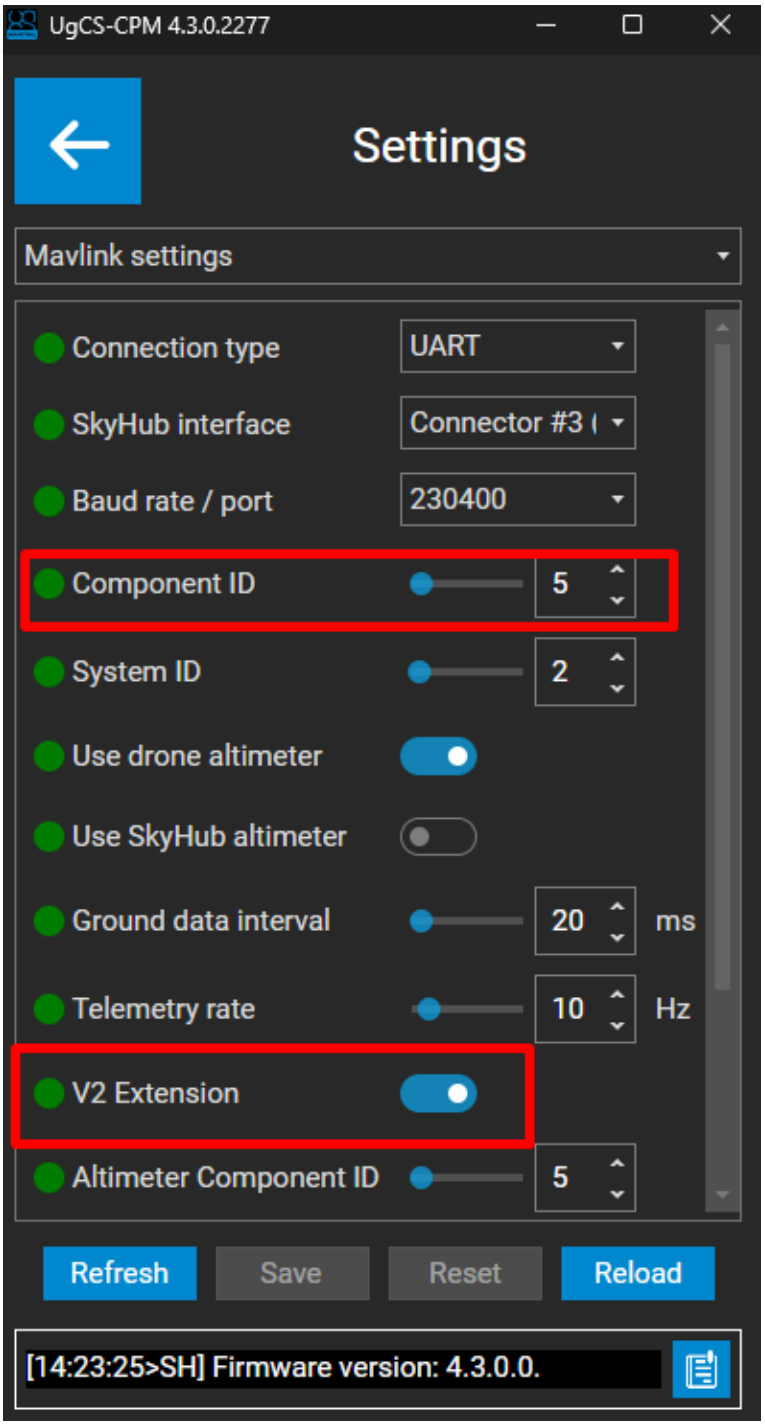



Figure 11.4. MAVLINK settings

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`.

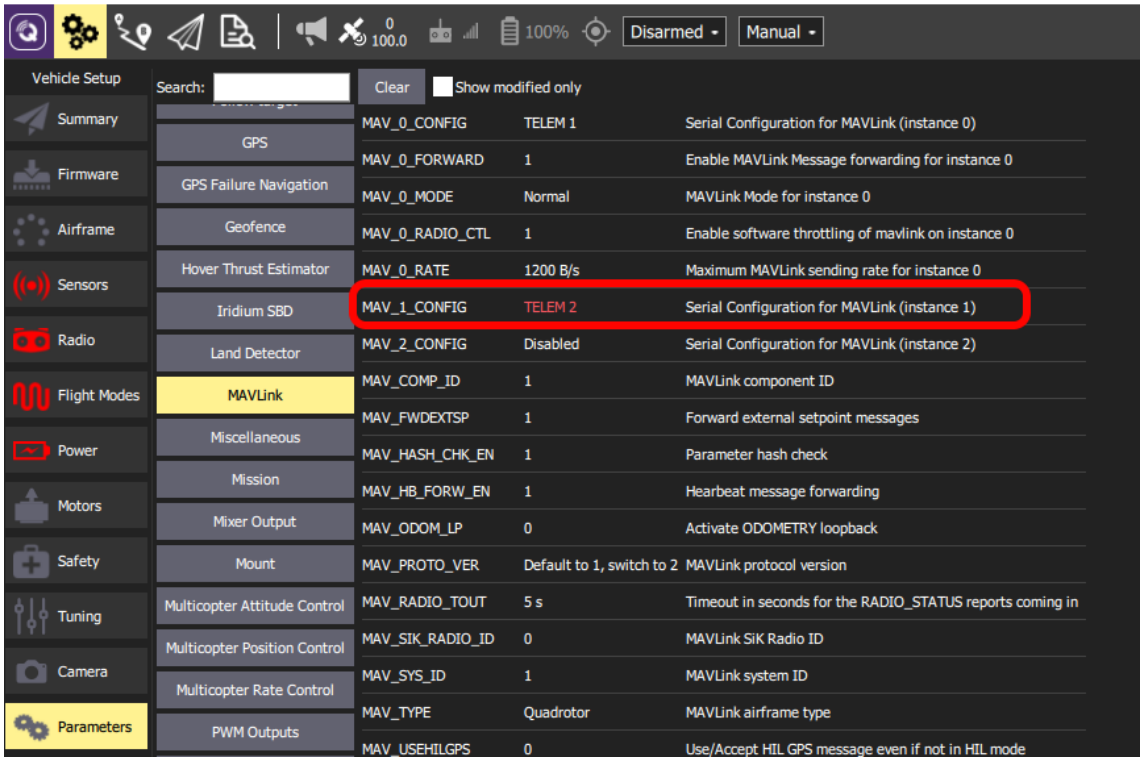



Figure 11.5. SkyHub PX4 TELEM2 port configuration

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`.

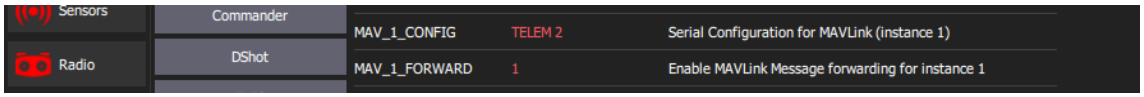



Figure 11.6. SkyHub PX4 TELEM2 port data forwarding configuration

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.

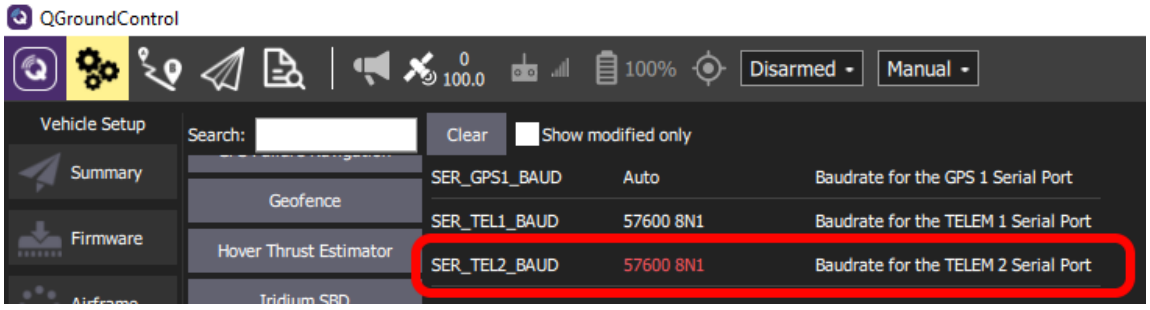



Figure 11.7. SkyHub PX4 TELEM2 port baudrate configuration

**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

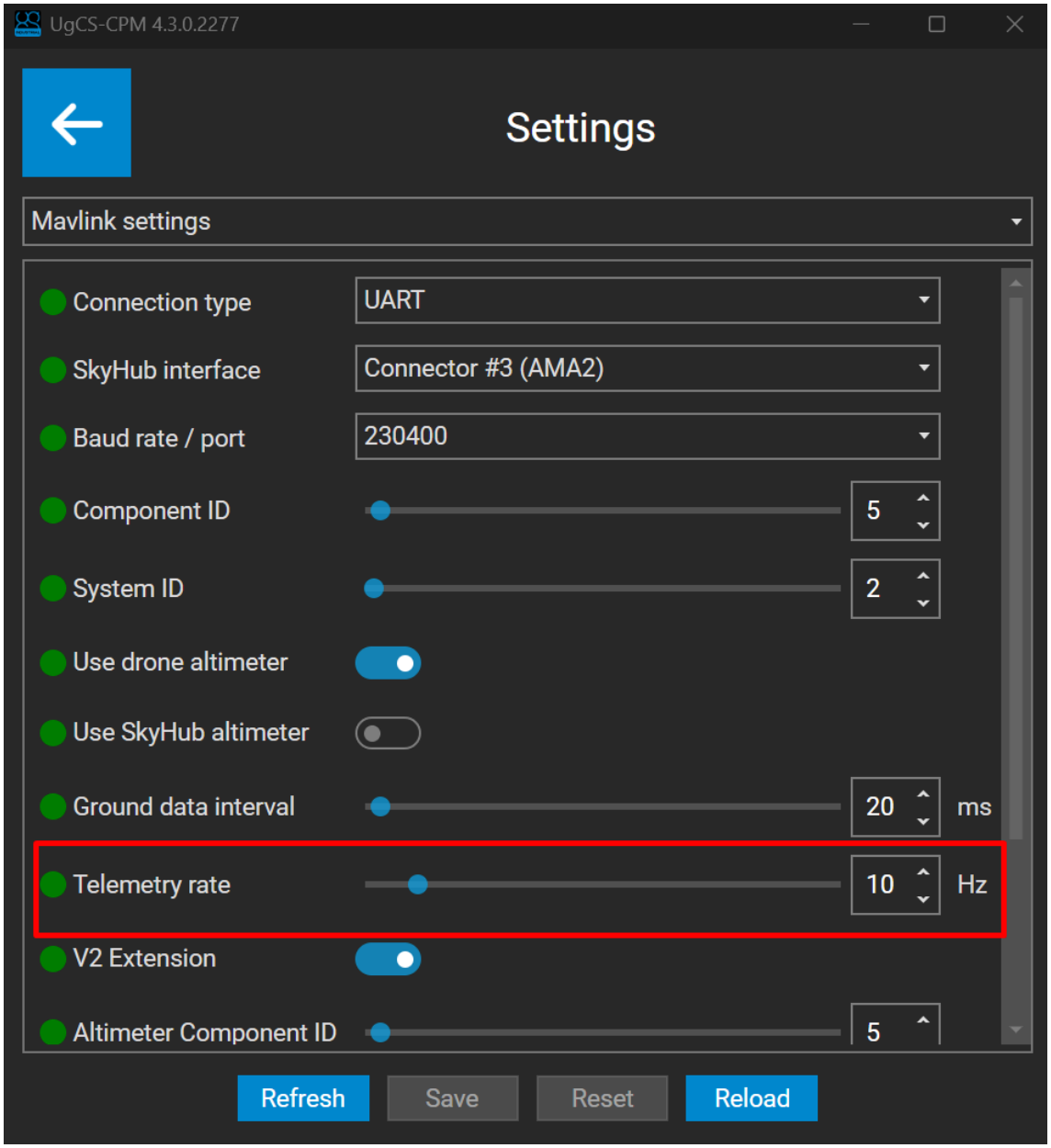



Figure 11.8. Mavlink telemetry rate

# 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”.

## 12.1 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”.

## 13.1 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”.

## 14.1 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 |

# Zond Aero NG & LF

**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 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.

## 15.1 Zond Aero NG & LF Configuration Parameters

| 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), 0.036 ns (#1), 0.071 ns (#2), 0.089 ns (#3), 0.125 ns (#4), 0.143 ns (#5), 0.179 ns (#6), 0.250 ns (#7), 0.357 ns (#8), 0.500 ns (#9), 0.625 ns (#10), 0.714 ns (#11), 1.000 ns (#12), 1.250 ns (#13), 2.500 ns (#14) | Encodes the trace time range per sample. |
| Sample count | 256 | | | | | 32, 64, 128, 256, 512, 1024, 2048, 4096, 8192 | Sample count per trace |
| Stacking | 128 | | | | | 4, 16, 64, 128, 256, 512, 1024, 2048, 4096, 8192, 16384, 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, 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 |
| Data 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 How often to send the values to the CPM |

# Zond Aero GPR

**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.

## 16.1 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 |
| Data 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 How often to send the values to the CPM |

# SBES: EchoLogger

**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 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”.

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

| Parameter | Default | Min | Max | Precision | Unit | Options | Description |
|---|---|---|---|---|---|---|---|
| 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 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 | 10 | 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 |

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

| Parameter | Default | Min | Max | Precision | Unit | Options | Description |
|---|---|---|---|---|---|---|---|
| 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 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 | 10 | 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 |

# MBES: Cerulean Surveyor 240-16

**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”.

## 18.1 MBES: Cerulean Surveyor Configuration Parameters

| Parameter | Default | Min | Max | Precision | Unit | Options | Description |
|---|---|---|---|---|---|---|---|
| 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 |
| Cable length | 1.6 | 0 | 5 | 0.01 | m | | Distance from altimeter to bottom of echosounder |
| 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 | 192.168.0.10 | | | | | | NTP server IP address |
| Payload Id | 192 | 192 | 220 | 1 | | | Payload Id |

# Magnetometer MagNIMBUS

MagNIMBUS comes in two possible configurations:

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

## 19.1 Single sensor assembly

**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 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”.

## 19.2 Gradiometer assembly

**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 cable to SkyHub Connector #4 (white).
- Attach vertical mast on the left side of the drone.

---

**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.

## 19.3 Magnetometer MagNIMBUS Configuration Parameters

| Parameter | Default | Min | Max | Precision | Unit | Options | Description |
|---|---|---|---|---|---|---|---|
| Sensor data rate | 4 | | | | ms | 1, 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, NOTCH_50HZ, NOTCH_60HZ, HP_10HZ, HP_20HZ, LP_10HZ, 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 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Accelerometer log | ON | | | | | ON, OFF | Enables logging of IMU's accelerometer 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, 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 for Primary sensor |
| Secondary connector | <empty> | | | | | <empty>, USB 1, USB 2 | 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”.

## 20.1 Magnetometer MagDrone R1 Configuration Parameters

| Parameter | Default | Min | Max | Precision | Unit | Options | Description |
|---|---|---|---|---|---|---|---|
| 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 | 115200 | | | | bps | 115200, 230400 | Connection port baud rate, 230400 recommended by manufacturer |
| Payload Id | 192 | 192 | 220 | 1 | | | Payload Id |

# Laser Falcon 1 / 2 Methane Detector

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

- 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.

## 21.1 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 | 1000 | 0 | 10000 | 1 | ppm | | Maximal gas concentration to report CPM |
| Zero level | 0 | 0 | 10000 | 1 | ppm | | Background compensation level |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency | 2 | | | | Hz | 1, 2 | Polling frequency to request data from the device |
| Serial device | Connector #4 (AMA3) | | | | | Connector #4 (AMA3), Connector #5 (AMA4), Connector USB1, Connector USB2 | SkyHub connector number where sensor is connected |
| Baud rate | 19200 | | | | bps | 9600, 19200, 115200 | Connection port baud rate, 19200 recommended by manufacturer |
| Altitude source | Default | | | | | Default, DJI (autopilot), Mavlink (autopilot) | The source of coordinate data |
| Data log dir | /data/skyhub_logs | | | | | | Path on SkyHub storage where data is saved |
| Payload Id | 192 | 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”.

## 22.1 Laser Falcon Plus Methane Detector Configuration Parameters

| Parameter | Default | Min | Max | Precision | Unit | Options | Description |
|---|---|---|---|---|---|---|---|
| IP address | 10.1.1.2 | | | | | | IP address of the device in the Ethernet network |
| 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 |

# 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”.

## 23.1 FluX methane Gas Detector Configuration Parameters

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

# 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”.

## 24.1 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”.

## 25.1 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 |
| Diagnostic mode | 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 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”.

## 26.1 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, GA | Two letters prefix for incoming messages ID: $<PREFIX><MESSAGE> |
| Payload Id | 192 | 192 | 220 | 1 | | | Payload Id |
| Serial device | Connector #4 (AMA3) | | | | | Connector #4 (AMA3), Connector #5 (AMA4) | SkyHub connector number 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”.

## 27.1 Universal Driver Configuration Parameters

| Parameter | Default | Min | Max | Precision | Unit | Options | Description |
|---|---|---|---|---|---|---|---|
| Serial device | Connector #4 (AMA3) | | | | | Connector #4 (AMA3), 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 | rn | | | | | | 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”.

## 28.1 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 | 1000.0 | 0.0 | 1000.0 | 0.01 | mps | | Maximal wind speed limit |
| Raw log | False | | | | | | Write raw data byte stream into separate log |
| Serial device | Connector #4 (AMA3) | | | | | Connector #4 (AMA3), Connector #5 (AMA4) | SkyHub connector number where altimeter is connected |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Baud rate | 38400 | | | | bps | 19200, 38400, 57600 | Connection port baud rate, 38400 recommended by manufacturer |
| Payload Id | 217 | 192 | 220 | 1 | | | Payload Id |

# Ebinger VEMOS AIR

**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".

## 29.1 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 (AMA3) | | | | | Connector #4 (AMA3), Connector #5 (AMA4) | SkyHub connector number where 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”.

## 30.1 Geolux LX-80-AB Configuration Parameters

| Parameter | Default | Min | Max | Precision | Unit | Options | Description |
|---|---|---|---|---|---|---|---|
| Can interface | can0 | | | | | 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”.

## 31.1 Geolux RSS-2-AB Configuration Parameters

| Parameter | Default | Min | Max | Precision | Unit | Options | Description |
|---|---|---|---|---|---|---|---|
| Altitude source | Default | | | | | Lightware SF30D, Ainstein 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 | can0 | | | | | | 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 |

# Drop Messenger

**Note** The water sampler 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 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”.

## 32.1 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). |

# True Terrain Following

## 33.1 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.

**Warning Attention:** due to elevation model error, real AGL altitude may differ from expected.

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.

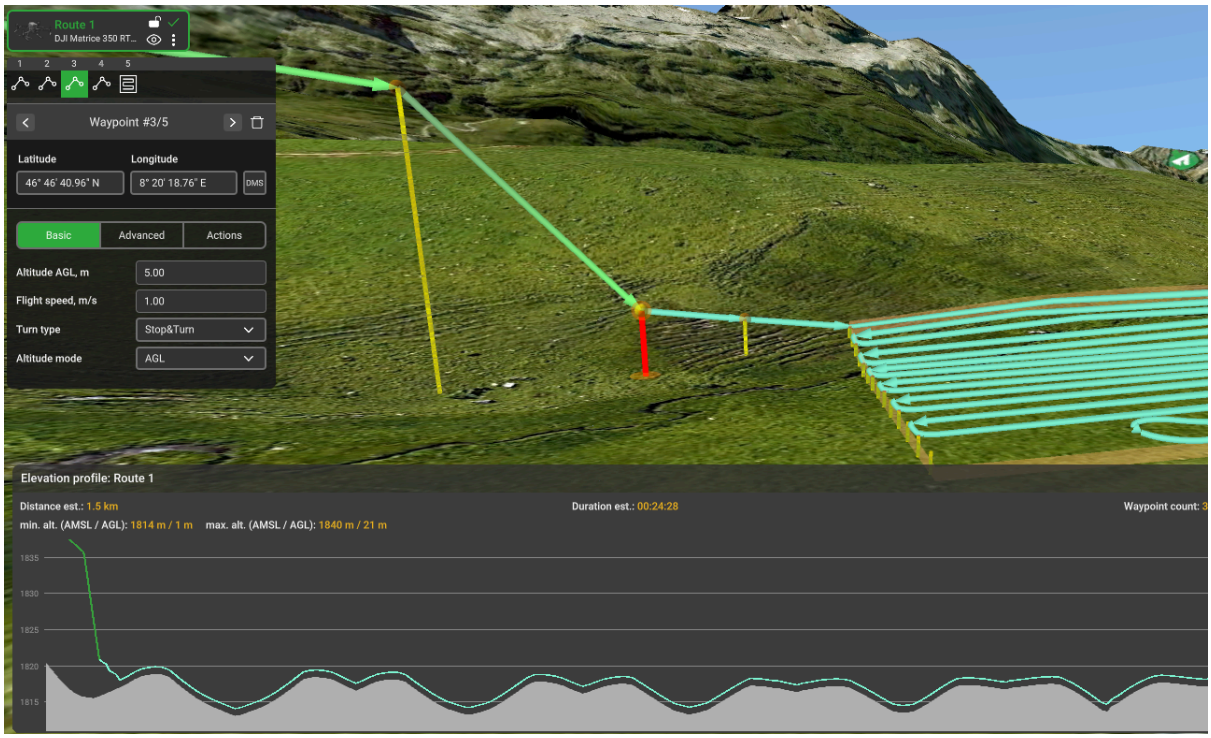



Figure 33.1. Transition from AGL to Rangefinder mode

**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.

## 33.2 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.

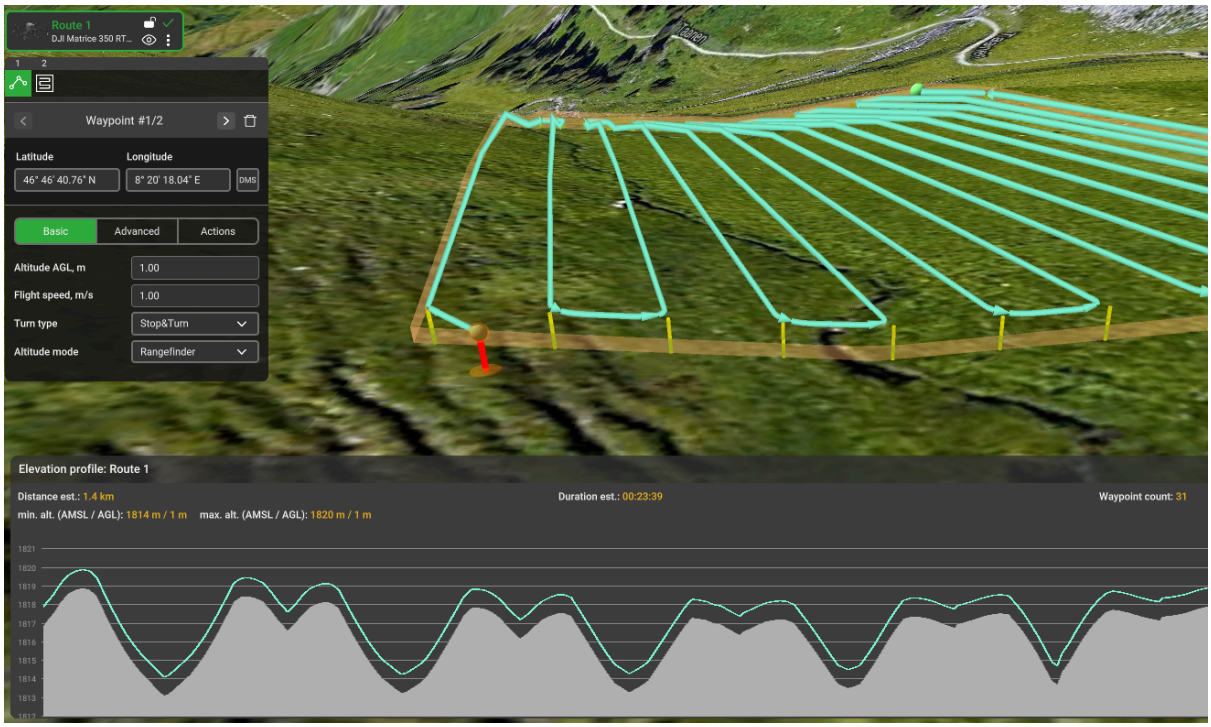



Figure 33.2. Route with all segments with Rangefinder altitude

## 33.3 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.

---

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.

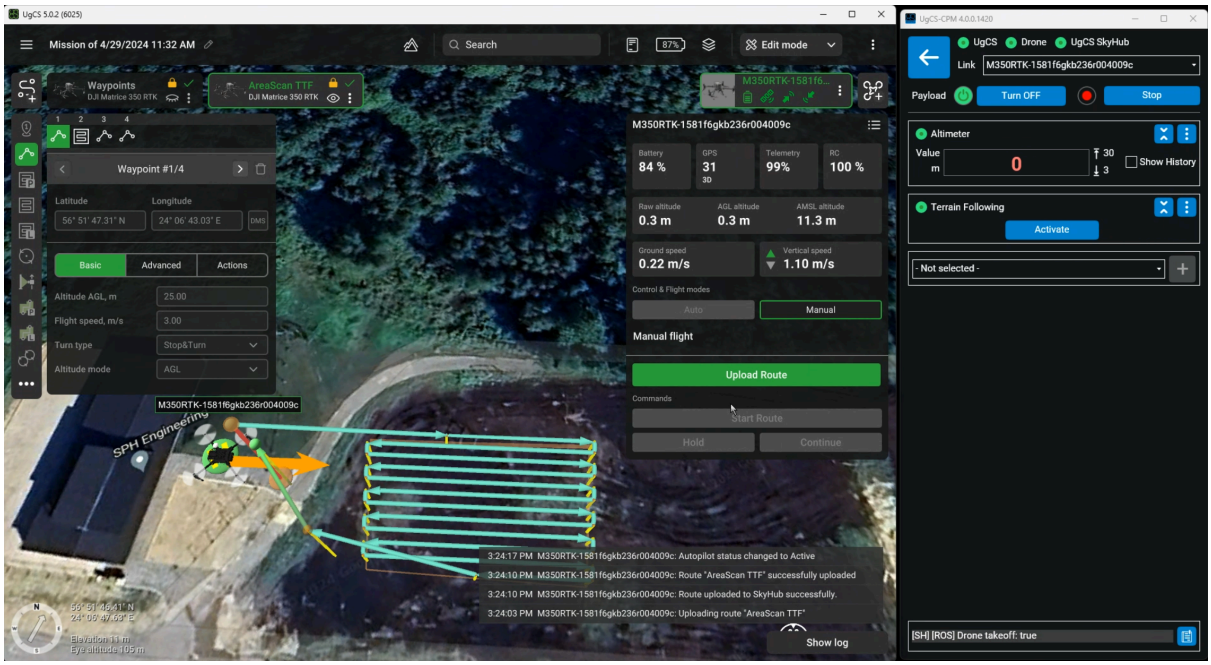



Figure 33.3. UgCS and UgCS-CPM application open side-by-side

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.

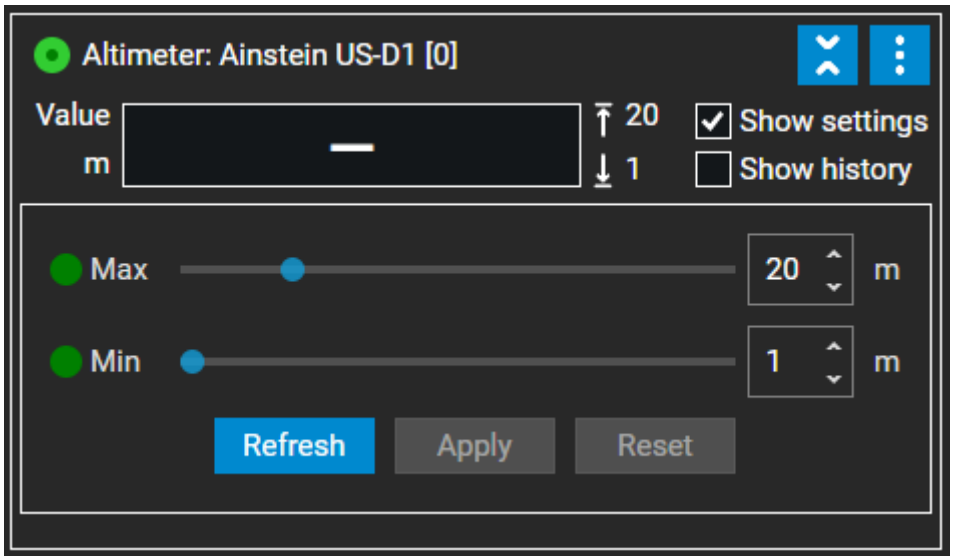



Figure 33.4. Altimeter Min/Max value setup

**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.

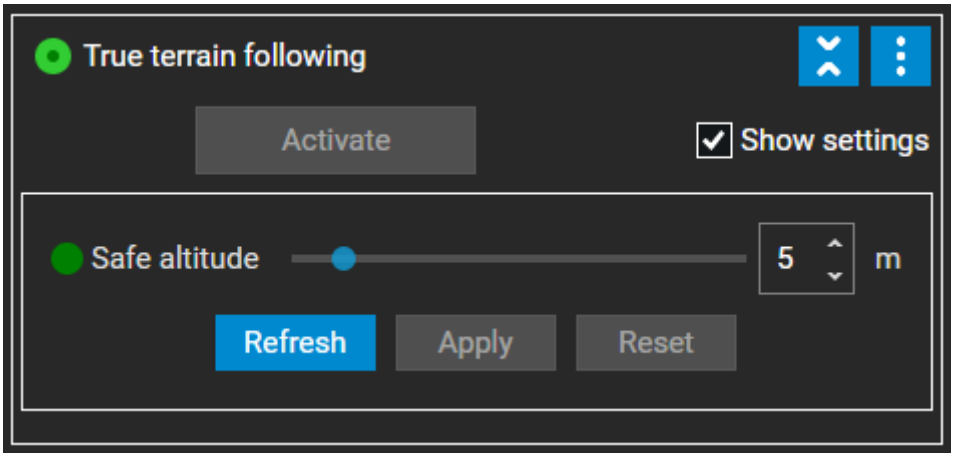



Figure 33.5. Altimeter safe altitude setup

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

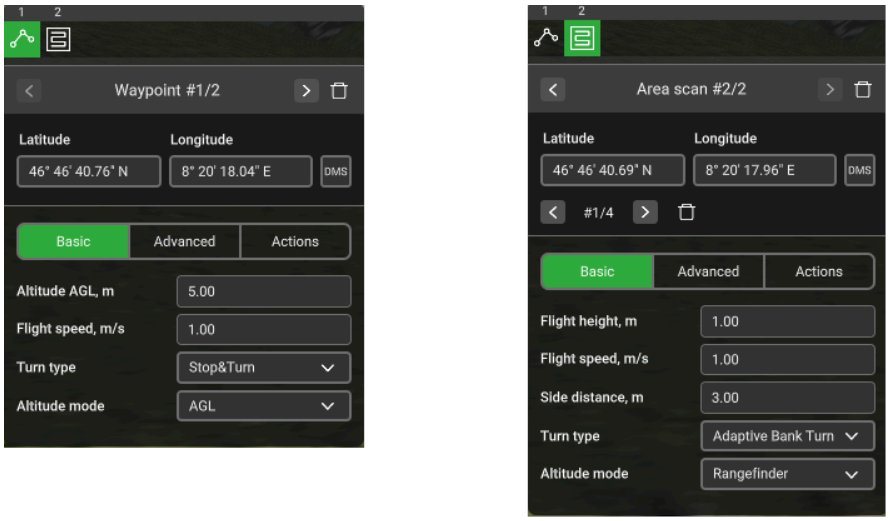



Figure 33.6. First waypoint / Area scan segment with Rangefinder altitude configured

**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.

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 Follwing 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 alti-

tudeto 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).

# Grasshopper Mode

## 34.1 Route requirements

Grasshopper action is executed on waypoints with **Wait action** assigned. Route may consist of mixed type of waypoints (Adaptive bank turn and Stop & turn), to navigate drone to survey area, and for survey have waypoints with **Wait action**. In the Grasshopper mode all waypoint turns will be executed as **Stop & turn**.

## 34.2 Flight

1. Start the PC and connect it to the Wi-Fi network. Start the UgCS and plan a mission for the drone. The descent points must be set as `wait` action, the wait duration defines waiting time in the descent point.
2. Turn on the drone, the payload, and SkyHub device.
3. Turn on the DJI Remote Controller and connect to the same Wi-Fi network as the PC. Be sure that the flight mode switch on the DJI Remote Controller is in `N`-mode. Run the UgCS Companion mobile application. Wait for the application to show the main window and connect to UgCS. The UgCS connection indicator in UgCS Companion should become green.
4. Ensure that the drone with a correct profile appears in the UgCS on the PC and all drone indicators (battery, uplink, downlink, satellites) are green. Select the drone and the mission.
5. Ensure that only the used payloads are enabled in the UgCS-CPM Payloads section. Each payload should be properly configured (see Sensors and Payloads part of the documentation).
6. Erase old log files if they are no longer needed (see Log Files Management for details).
7. Start the UgCS-CPM application and connect to UgCS with default credentials. Check 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.

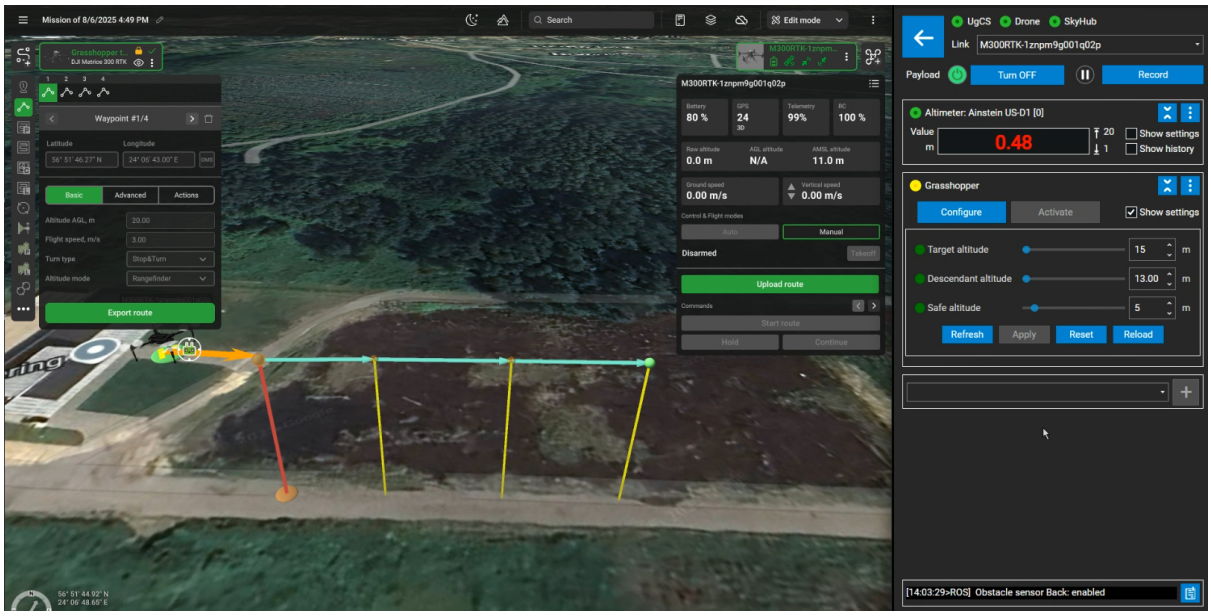



Figure 34.1. UgCS and UgCS-CPM application open side-by-side

8. Check the Altimeter widget for it displays the altimeter data. Check the altitude Min/Max limits in altimeter widget settings. Note that there is no data from the radar altimeter until the drone is moving. Gently shake the drone by hand until the altitude starts to change.

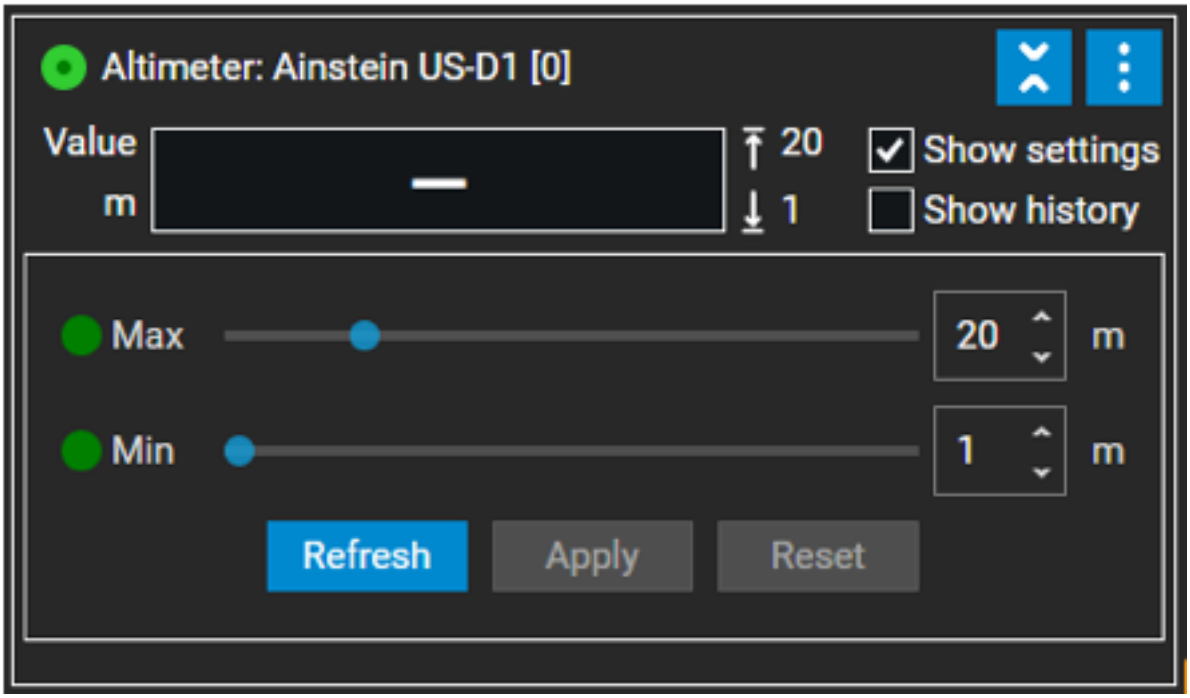



Figure 34.2. Altimeter Min/Max value configuration

9. Check the Altimeter widget for it displays the altimeter data. Note that there is no data from the radar altimeter until the drone is moving. Gently shake the drone by hand until the altitude starts to change.
10. Upload the route to the drone using UgCS. Once the route is uploaded to the SkyHub, Grasshopper parameter can be configured.

11. Go to the Grasshopper widget, press Refresh to read current GH settings.

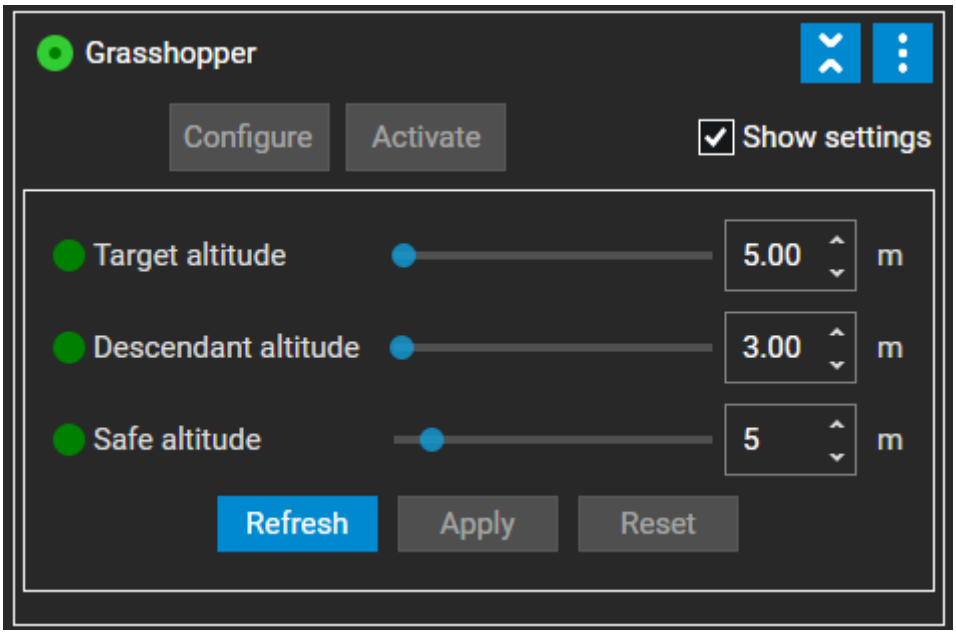



Figure 34.3. Grasshopper widget

12. Set `Target Altitude` for flight between measuring points in True Terrain Following mode. Set `Descent altitude` - altitude to which the drone will descend during Grasshopper action. Set `Safe altitude` - altitude to which the drone will ascend if the altimeter reading goes out of range and when the Grasshopper route is finished. Press `Apply` to save values.

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

13. Press the Configure button. Wait for the `Grasshopper ENABLED` message.
14. If there is no message mentioned above, change the flight mode switch to `F`-mode and back it to `N`-Mode, then try again to press the Configure button.
15. Take off using the DJI Remote Controller or from the UgCS and rise up to the appropriate altitude (see limits from step 8).
16. Press the Activate button in the Grasshopper widget to start the flight in grasshopper mode. The alternative way to activate it is to move the flight mode switch to `F`-mode or press Start in UgCS Companion application.
17. You may interrupt the flight by moving the flight mode switch to `N`-mode or by pressing the Pause button in the Grasshopper widget (UgCS-CPM), or Pause button in UgCS Companion application.

The flight can be resumed by moving the flight mode switch to `F`-mode, or by pressing the Resume button in the Grasshopper widget (UgCS-CPM), or Resume button in UgCS Companion application.

During pause you may manually control the drone, for example fly around an obstacle. In this case the drone returns to the nearest 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.

18. If the drone descends below the minimum allowed altitude or ascends above the maximum allowed altitude (see step 8), it stops, then climbs to increase its altitude to the value defined by the `Safe altitude` parameter in the Grasshopper widget, and then the route pauses.

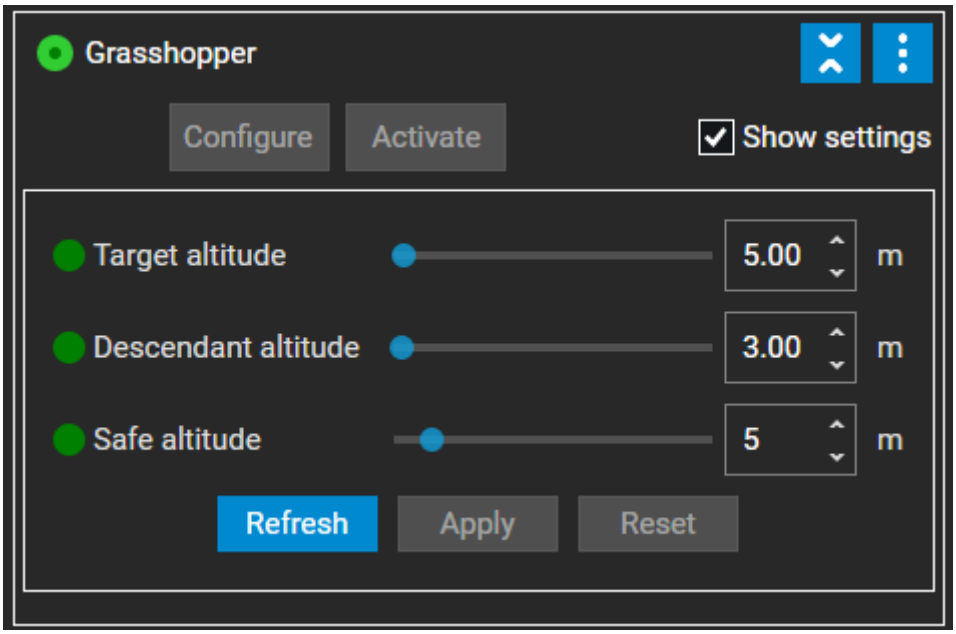



Figure 34.4. Grasshopper widget

You may manually correct drone position and resume the flight according to recommendations in the step 17.

19. After the mission has been completed, the drone stops at the last waypoint, then climbs to increase its altitude to the value defined by the `Safe altitude` parameter in the Grasshopper widget.
20. Return the drone to the desired landing position, and land. If the flight has been ended over the desired landing point, press the Land button in UgCS.
21. Download log files (see Log Files Management).

## 34.3 Configuration Parameters Summary

| Parameter | Default | Min | Max | Precision | Unit | 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 |
| Descendant altitude | 3.0 | 0.0 | 1000.0 | 0.01 | m | Grasshopper descent altitude |
| Target altitude | 5.0 | 0.0 | 1000.0 | 0.01 | m | Grasshopper flight target altitude |
| Descent speed | 1.0 | 0.0 | 1000.0 | 0.01 | m | Descent speed at grasshopper action points |

# Obstacle Avoidance

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 additional altimeter to both DJI and MAVLink-controlled drones.

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.

## 35.1 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).

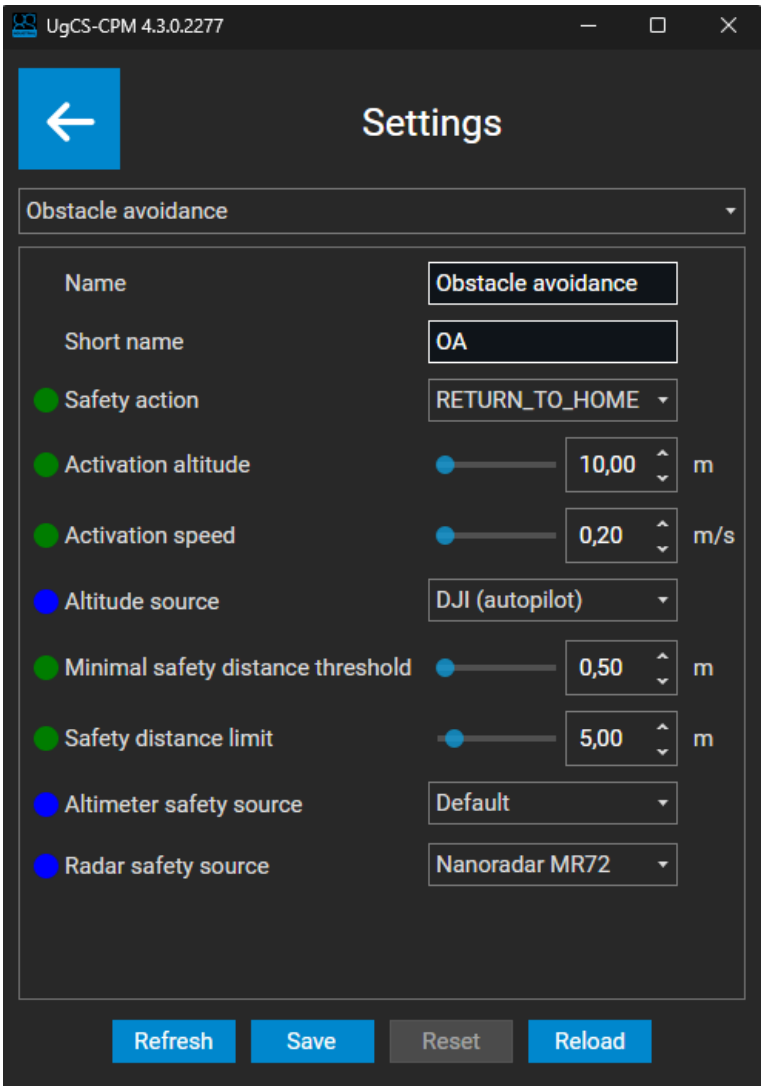



Figure 35.1. UgCS-CPM, Obstacle avoidance settings

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.

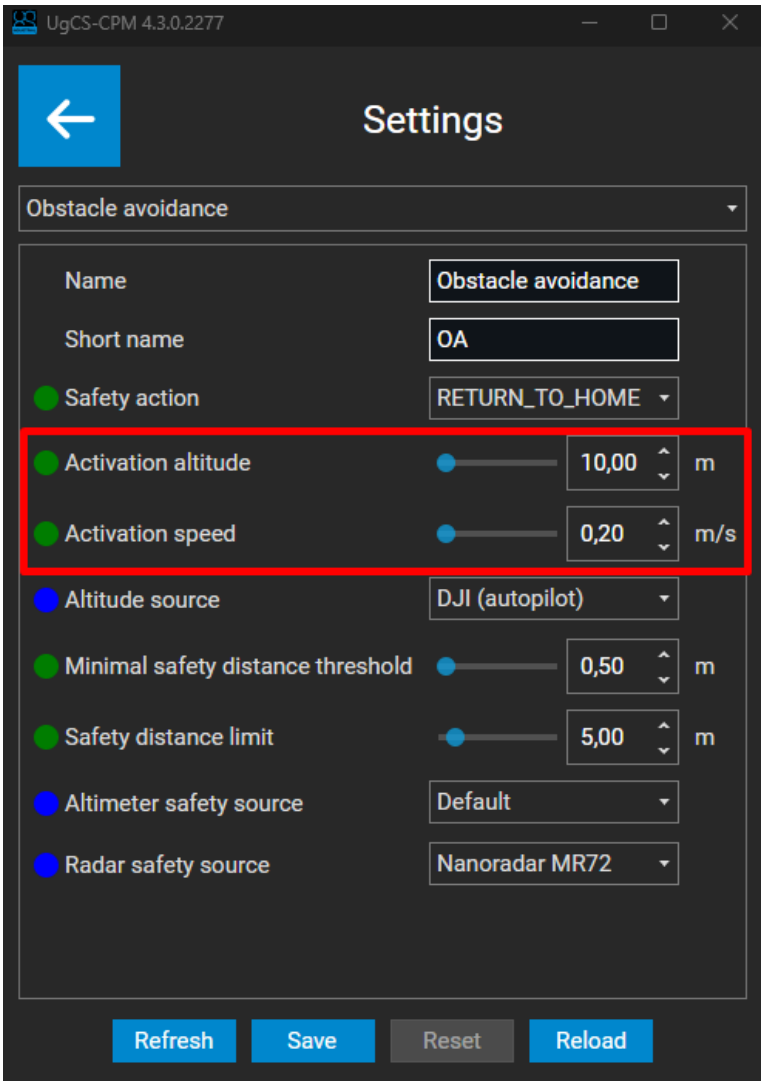



Figure 35.2. UgCS-CPM, Obstacle avoidance activation values

**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.

## 35.2 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. |

## 35.3 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.

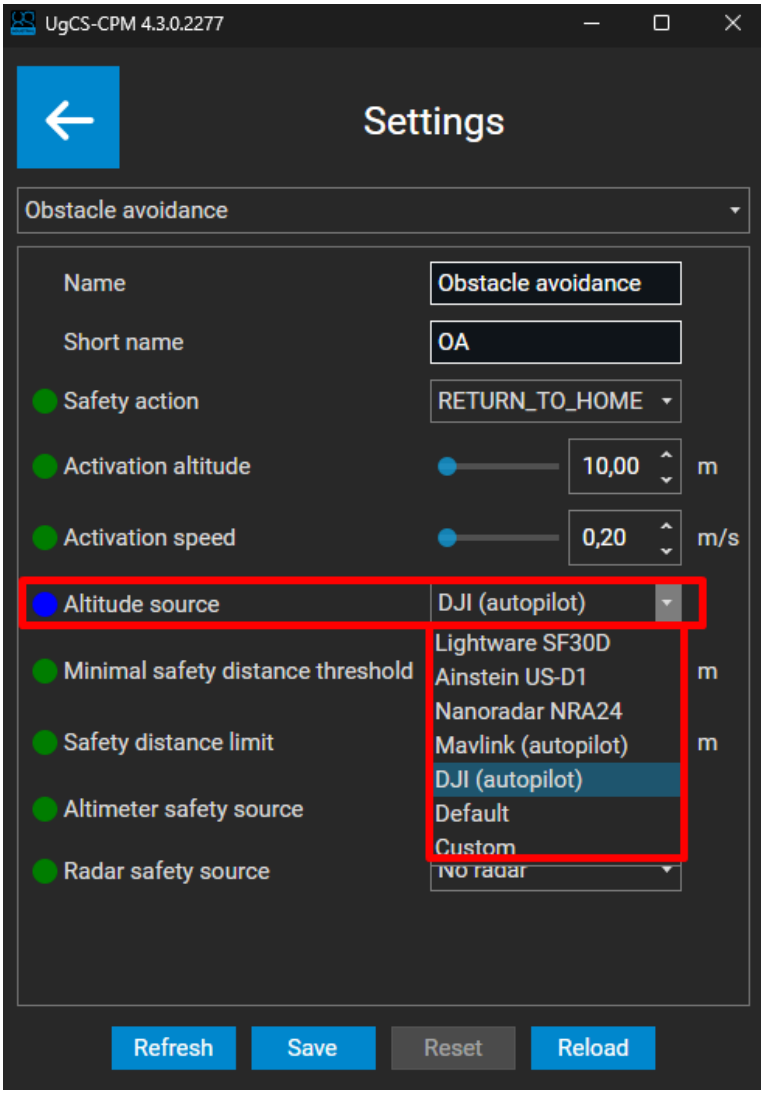



Figure 35.3. UgCS-CPM, Obstacle avoidance altitude sources

## 35.4 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 two 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.

**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.

### 35.4.1 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.

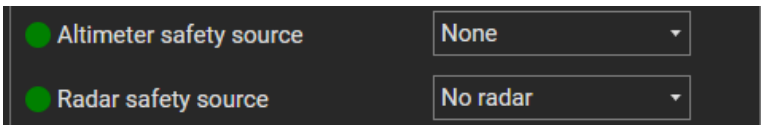



Figure 35.4. UgCS-CPM, setup with no external radar

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 35.5. UgCS-CPM, setup with external radar

## 35.5 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 | 10.0 | 0.0 | 500.0 | 0.01 | m | | Obstacle Avoidance activation altitude |
| Activation speed | 4.0 | 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 |
| Minimal safety distance 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 |

Chapter 36

# About Log Files

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. These files can be processed in Pergam's proprietary software.

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:

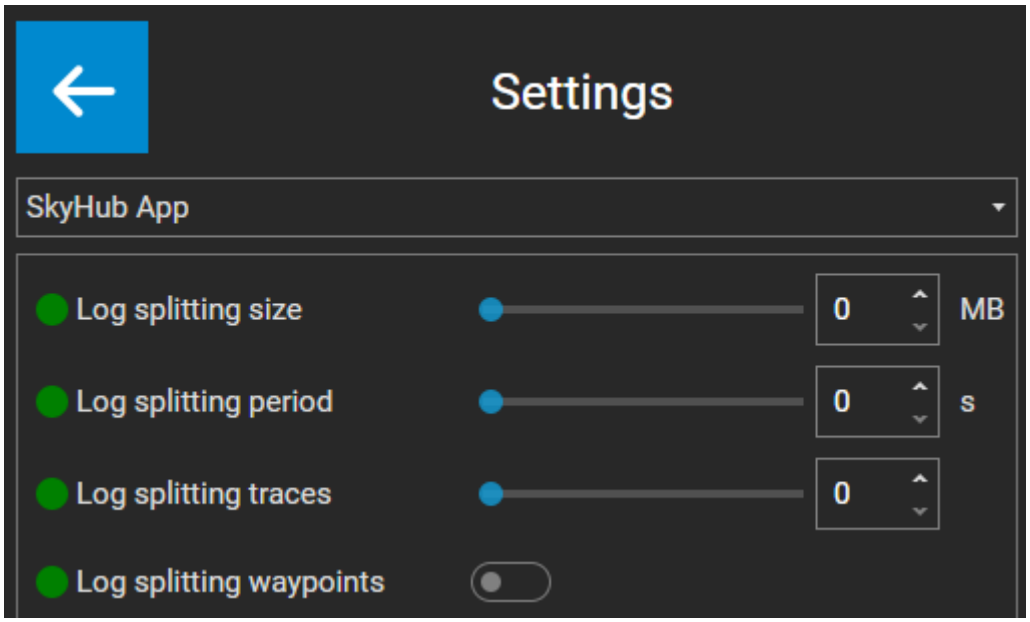



Figure 36.1. UgCS-CPM Logging Settings

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.

Chapter 37

# Position Log

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.

## 37.1 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. |

## 37.2 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. |

## 37.3 Altimeter Columns Description

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

## 37.4 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 |

## 37.5 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 |

## 37.6 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 |

## 37.7 Pergam 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 |

## 37.8 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 |

## 37.9 Ground-Penetrating Radar Columns Description

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

## 37.10 Ebinger VEMOS AIR Columns Description

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

## 37.11 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 |

## 37.12 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 |

# Log Files Management

## 38.1 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”.

## 38.2 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.

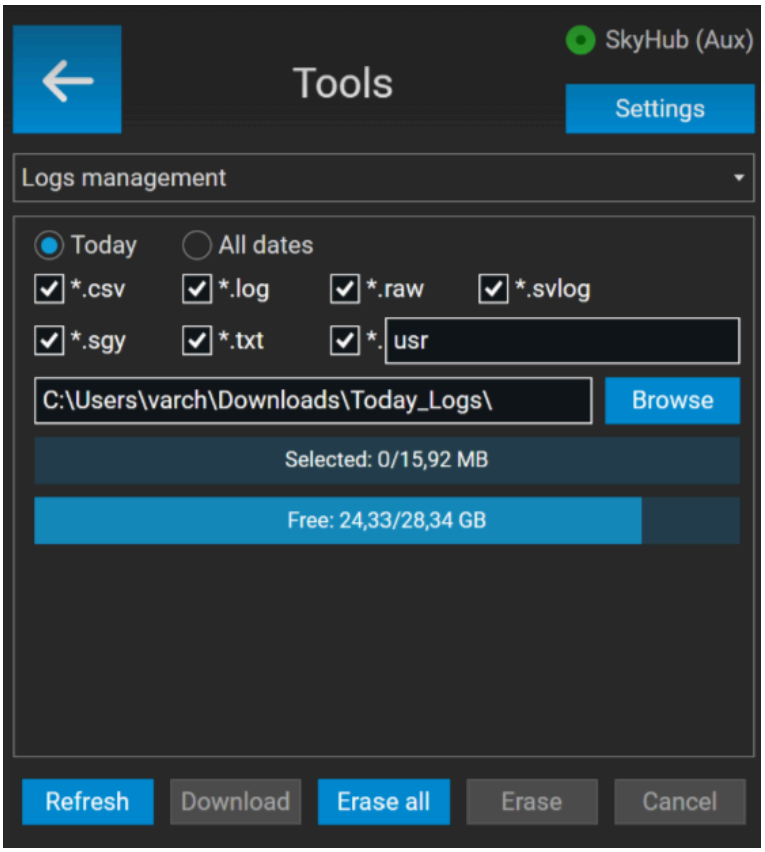



Figure 38.1. UgCS-CPM Log management window

# Upgrade/Downgrade Firmware

**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.

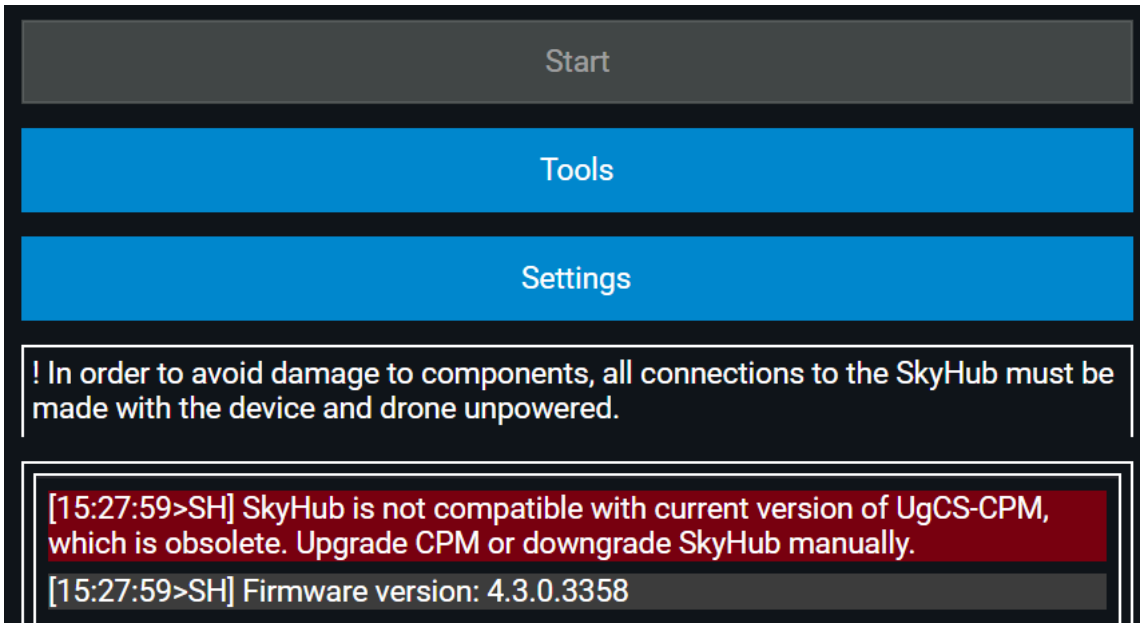



Figure 39.1. UgCS-CPM Firmware mismatch message

## 39.1 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.

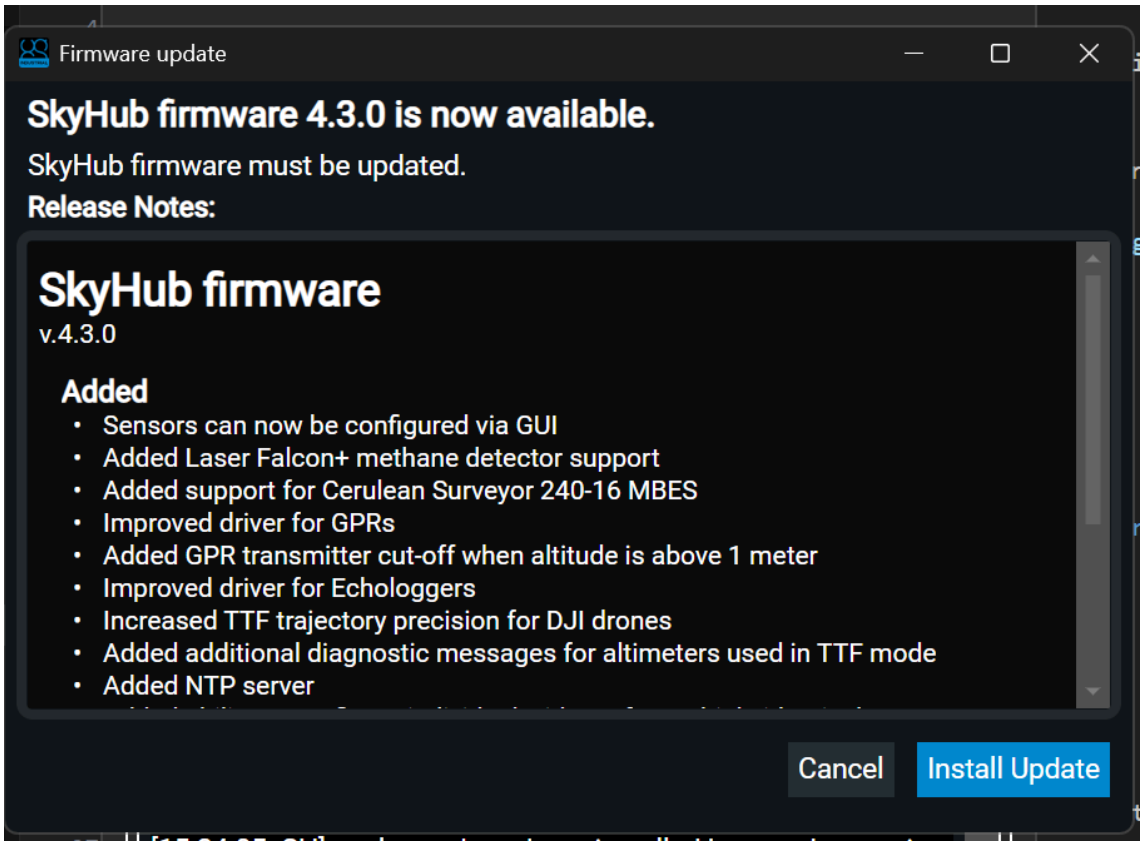



Figure 39.2. UgCS-CPM Firmware upgrade popup

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.

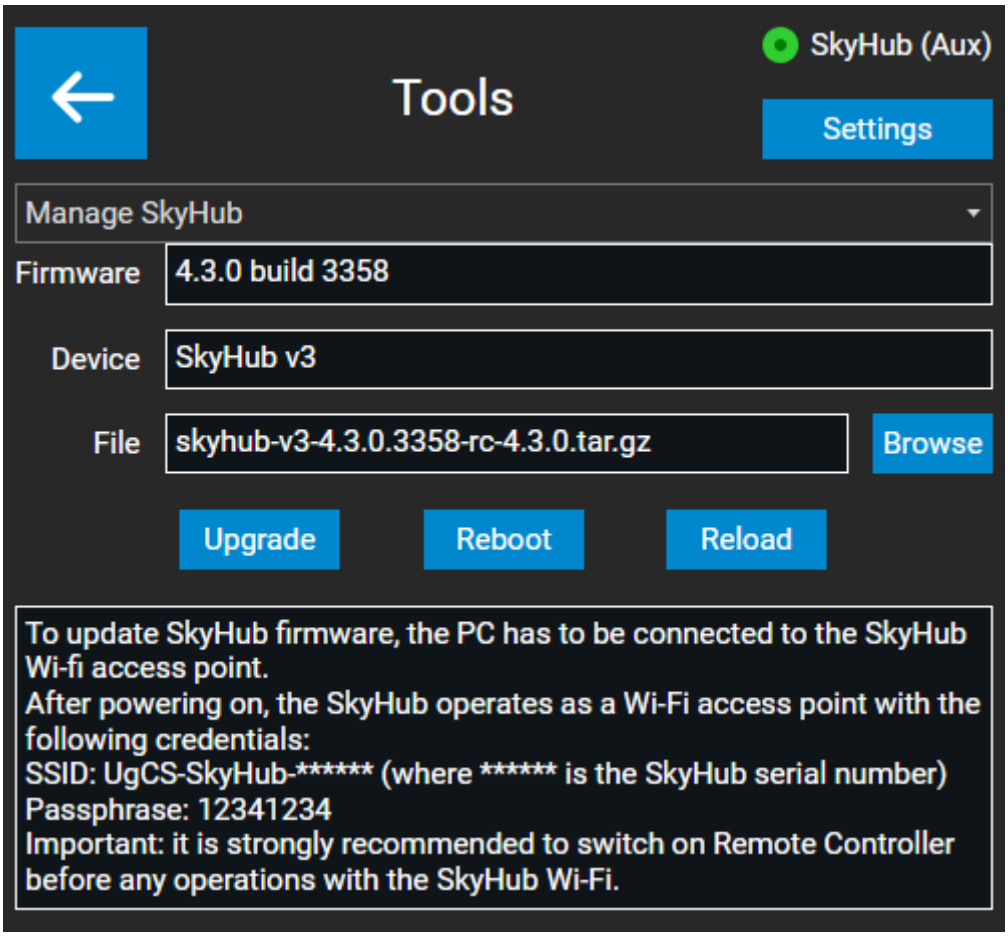



Figure 39.3. UgCS-CPM Manage SkyHub Section

**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*

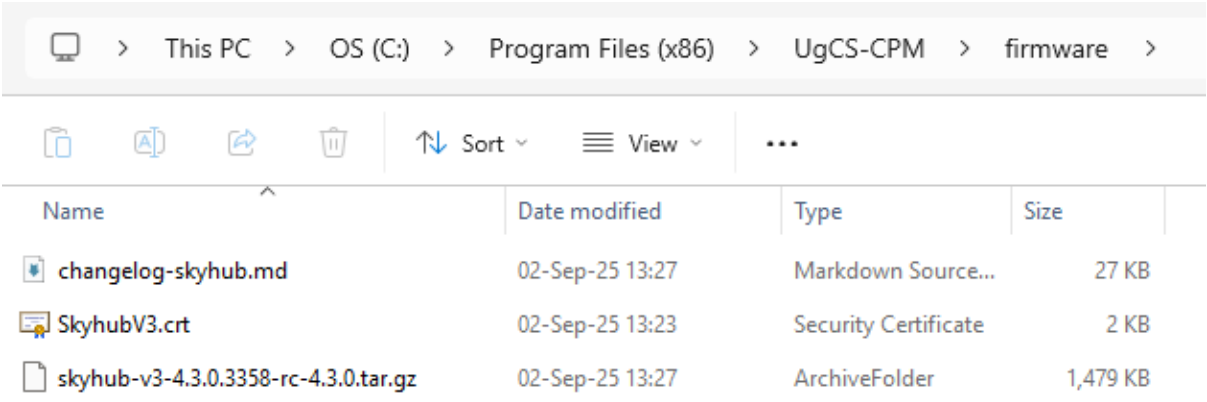



Figure 39.4. UgCS-CPM Firmware folder

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.

## 39.2 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.

# Configuration Parameter Reference

## 40.1 SkyHub Configuration Parameters

### 40.1.1 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 stauts 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 |

### 40.1.2 Autopilots Settings

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

| | | | |
|---|---|---|---|
| MAVLINK | False | | Enable SkyHub communication with Pixhawk based autopilots |

### 40.1.3 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 | 10.0 | 0.0 | 500.0 | 0.01 | m | | Obstacle Avoidance activation altitude |
| Activation speed | 4.0 | 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 |
| Minimal safety distance 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 |

### 40.1.4 Grasshopper Flightmode Settings

| Parameter | Default | Min | Max | Precision | Unit | 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 |
| Descendant altitude | 3.0 | 0.0 | 1000.0 | 0.01 | m | Grasshopper descent altitude |
| Target altitude | 5.0 | 0.0 | 1000.0 | 0.01 | m | Grasshopper flight target altitude |
| Descent speed | 1.0 | 0.0 | 1000.0 | 0.01 | m | Descent speed at grasshopper action points |

### 40.1.5 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 | The first configured altimeter | | | | | Lightware SF30D, Ainstein US-D1, Nanoradar NRA24, Mavlink (autopilot), The first configured altimeter | Default altimeter selection for flight navigation |

### 40.1.6 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 | 2 | 1 | 200 | 1 | | | Mavlink Payload ID for SkyHub altimeter |
| Active altimeter | Default | | | | | Lightware SF30D, Ainstein US-D1, Nanoradar NRA24, Mavlink (autopilot), Default | Altimeter which readings are used for position data Must be selected when SkyHub altimeter is forwarded over Mavlink |

- genindex
- search