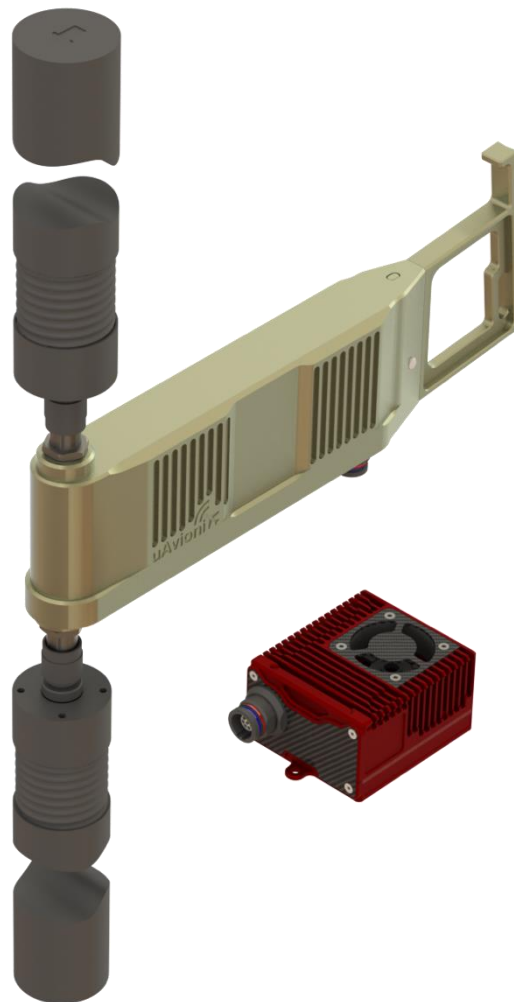




# SkyLink5060

## User and Installation Manual

REVISION C



# 1 Proprietary Rights

© 2022 uAvionix Corporation. All rights reserved.

Except as expressly provided herein, no part of this guide may be reproduced, transmitted, disseminated, downloaded, or stored in any storage medium, for any purpose without the express written permission of uAvionix. uAvionix grants permissions to download a single copy of this guide onto an electronic storage medium to be viewed for personal use, provided that the complete text of this copyright notice is retained. Unauthorized commercial distribution of this manual or any revision hereto is strictly prohibited.

uAvionix® is a registered trademark of uAvionix Corporation and may not be used without express permission of uAvionix.

## 2 Warranty

uAvionix products are warranted to be free from defects in material and workmanship for one year from purchase. For the duration of the warranty period, uAvionix, at its sole option, will repair or replace any product which fails under normal use. Such repairs or replacement will be made at no charge to the customer for parts or labor, provided that the customer shall be responsible for any transportation cost.

This warranty does not apply to cosmetic damage, consumable parts, damage caused by accident, abuse, misuse, water, fire or flood, damage caused by unauthorized servicing, or product that has been modified or altered.

IN NO EVENT, SHALL UAVIONIX BE LIABLE FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES, WHETHER RESULTING FROM THE USE OF, MISUSE OF, OR INABILITY TO USE THE PRODUCT OR FROM DEFECTS IN THE PRODUCT. SOME STATES DO NOT ALLOW THE EXCLUSION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU.

Warranty repair service shall be provided directly by uAvionix.

### 3 Revision History

Revision	Date	Comments
A	January 2022	Initial Release
B	April 29 2022	Updates to installation procedures and updated diagrams
C	November 17 2022	Updated to reflect new firmware and software revisions. Fix errors in wiring diagram.

## 4 Regulatory Statements

### 4.1 FCC Statement

The following required statement from the Federal Communications Commission (FCC) applies to United States based entities with the exception of direct sales to the U.S. Government and units directly exported by uAvionix:

*This device has not been authorized as required by the rules of the Federal Communications Commission. This device is not, and may not be, offered for sale or lease, or sold or leased, until authorization is obtained.*

### 4.2 SkyLink5060 Use Prior to FCC Authorization

Those wishing to use SkyLink5060 airborne and SkyStation5060 ground radios before they receive FCC authorization must request one or more Experimental FCC Transmit Licenses.

First, though, one or more FAA Coordination Numbers must be requested and obtained, signifying the FAA's approval to use its protected C-band frequencies. Once obtained, each FCC transmit authorization applies to:

- One or more center frequencies
- Over a specific geographic area centered on a particular Latitude and Longitude
- Up to a specific maximum flight altitude or antenna height
- A specific duration of calendar time (e.g., six months)

For help with the FAA and FCC application processes, contact [support@uavionix.com](mailto:support@uavionix.com).

You can also reach out to Jim Davis, Director of Policy and Regulatory Affairs, at [jim.davis@uavionix.com](mailto:jim.davis@uavionix.com).

## 5 Warnings

Thoroughly read and understand this user manual before handling products. Failure to do so may result in damage to the product and a voided warranty.

- DO NOT apply more than 32 Volts DC to the radios.
- DO NOT apply power to radios without antennas or RF loads connected.

## 6 Contents

1	Proprietary Rights .....	2
2	Warranty .....	2
3	Revision History .....	3
4	Regulatory Statements .....	4
4.1	FCC Statement .....	4
4.2	SkyLink5060 Use Prior to FCC Authorization .....	4
5	Warnings .....	4
6	Contents .....	5
7	Introduction .....	7
8	System Overview .....	7
9	Installation .....	9
9.1	SkyStation5060 Ground Radio System (GRS) .....	9
9.1.1	Mounting SkyStation5060 GRS .....	9
9.1.2	Mounting SkyLink Hub .....	11
9.1.3	Connections .....	12
9.2	SkyLink5060 Airborne Radio System (ARS) .....	14
9.2.1	Mounting SkyLink5060 ARS .....	14
9.2.2	Connections .....	14
10	Configuration .....	16
10.1	SkyLinkHUB .....	16
10.2	SkyStation5060 Ground Radio System (GRS) .....	19
10.3	SkyLink5060 Airborne Radio System (ARS) .....	21
11	Operation .....	22
11.1	Radio Link .....	22
11.2	Mission Planner Example .....	23
11.3	Piccolo Command Center Example (PCC) .....	24
12	Firmware Update .....	25

12.1	Hub Firmware Update .....	25
12.2	SkyStation5060 GRS Radio Firmware Update.....	26
12.3	SkyLink5060 Radio Firmware Update .....	27
13	Support.....	27

## 7 Introduction

SkyLink5060 is an aviation-protected C-Band (5030-5091 MHz) bi-directional, Multiple Input Single Output (MISO) dual Control and Non-Payload Communications (CNPC) radio system. Compliant with the RTCA DO-362A standard, SkyLink5060 provides the information exchange required for operators to safely control, monitor, and manage Unmanned Aircraft Systems (UAS).

SkyLink5060 and SkyStation5060 radios seamlessly integrate with the uAvionix SkyLine infrastructure, the first enterprise managed command and control (C2) network. Skyline includes autonomous make-before-break roaming between SkyStation5060 ground radios and applications for planning, operating, and monitoring real-time missions.

## 8 System Overview

### SkyLink5060 Kit Components

	Component	Part Number
1	SkyStation5060 Ground Radio System (GRS)	UAV-1006090-001
2	SkyLink5060 Airborne Radio System (ARS)	UAV-1006082-001
3	SkyLink Hub	UAV-1006103-001
4	truFYX GPS	UAV-1004957-001
5	Two GRS Directional Antennas	UAV-1006176-001
6	Two ARS Omnidirectional Antennas	UAV-1006288-001
7	GRS to Hub Wire Harness	UAV-1006647-001
8	M12 X-Coded Ethernet Cable	UAV-1005899-001
9	ARS Wire Harness	UAV-1006648-001
10	GRS Pole Mounting Kit (angled bracket)	UAV-1006267-001
11	Hub Pole Mounting Kit	UAV-1006270-001
12	RS-232 to TTL Pixhawk Adapter	UAV-1006282-001
13	SMA Coaxial antenna leads	
14	SkyLinkApp and Documentation	

### SkyStation5060 and SkyLink5060 Radio Systems

Each SkyLink radio system is a purpose-built diversity system with two receive channels and one transmit channel. The system includes built-in link management that handles remote configuration and performance statistics.

#### *User Data Link*

- Transparent bi-directional CNPC data link between GRS and ARS

#### *Control Data Link*

- Link management signaling between GRS and ARS including roaming functions when passing pilot control from Serving GRS to Target GRS.

The SkyLink Hub provides a GPS receiver, power supply, communications, and network access to the ground system.

The truFYX provides GPS signal to the SkyLink5060 airborne radio system (ARS). Internal and external mount configurations are available.

Figure 1 shows a typical system with a SkyStation5060 Ground Radio System (GRS) and a SkyLink5060 Airborne Radio System (ARS) managed by uAvionix SkyLine infrastructure.

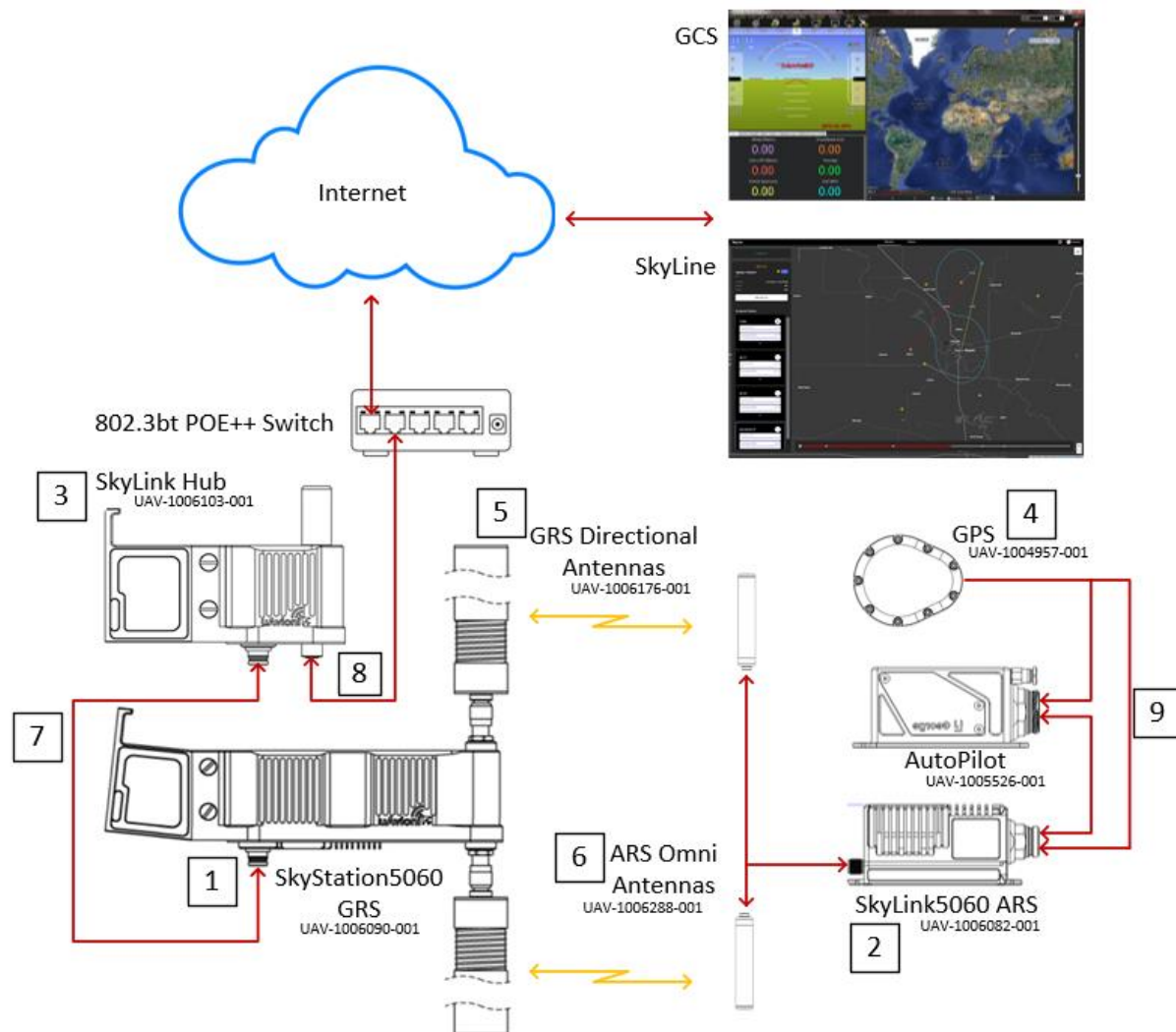


Figure 1 – SkyLink5060 Radios with SkyLine Infrastructure



## 9 Installation

### 9.1 SkyStation5060 Ground Radio System (GRS)

#### 9.1.1 Mounting SkyStation5060 GRS

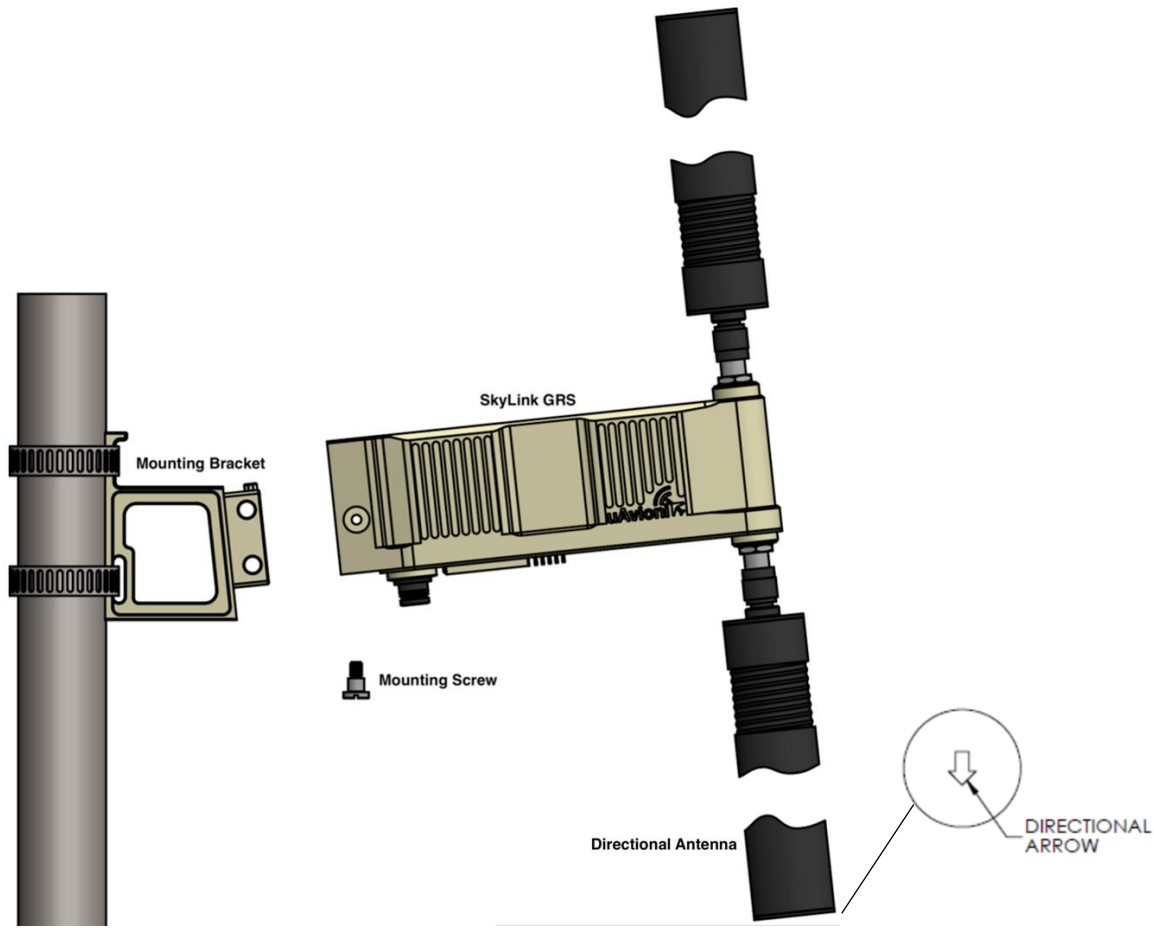
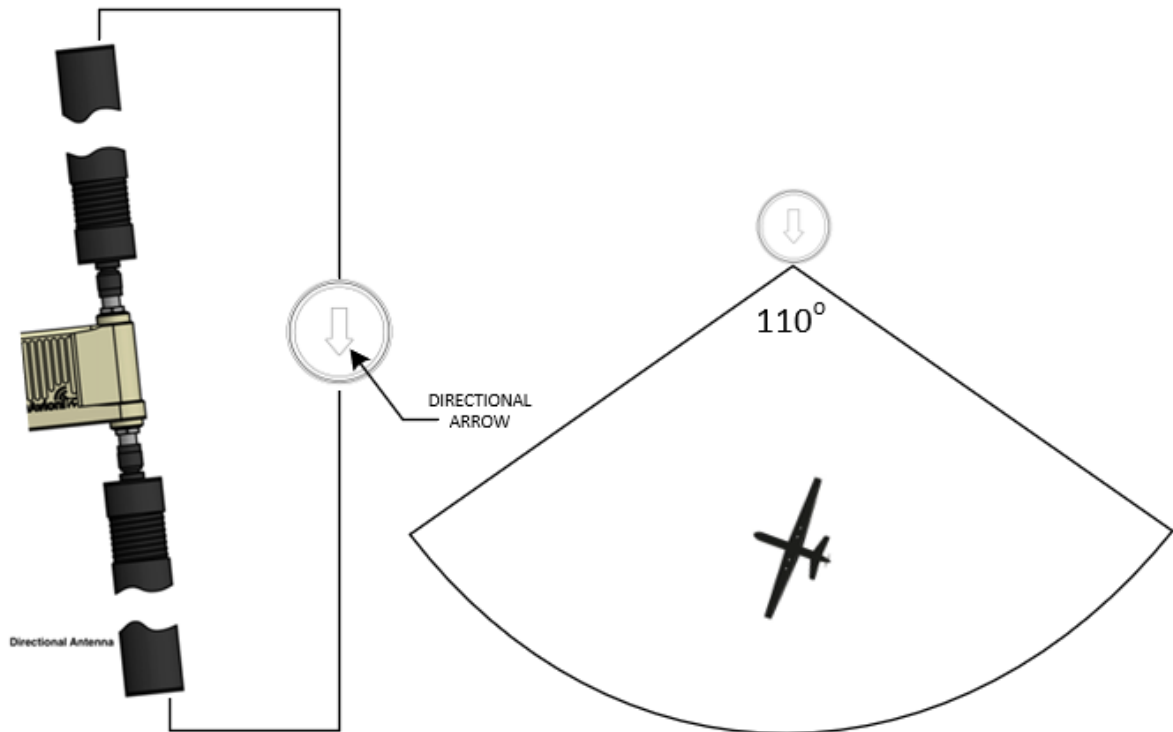


Figure 2 - Mounting SkyStation5060 GRS

The SkyStation5060 GRS Mounting Bracket is angled 6 degrees upward to maximize airborne coverage.

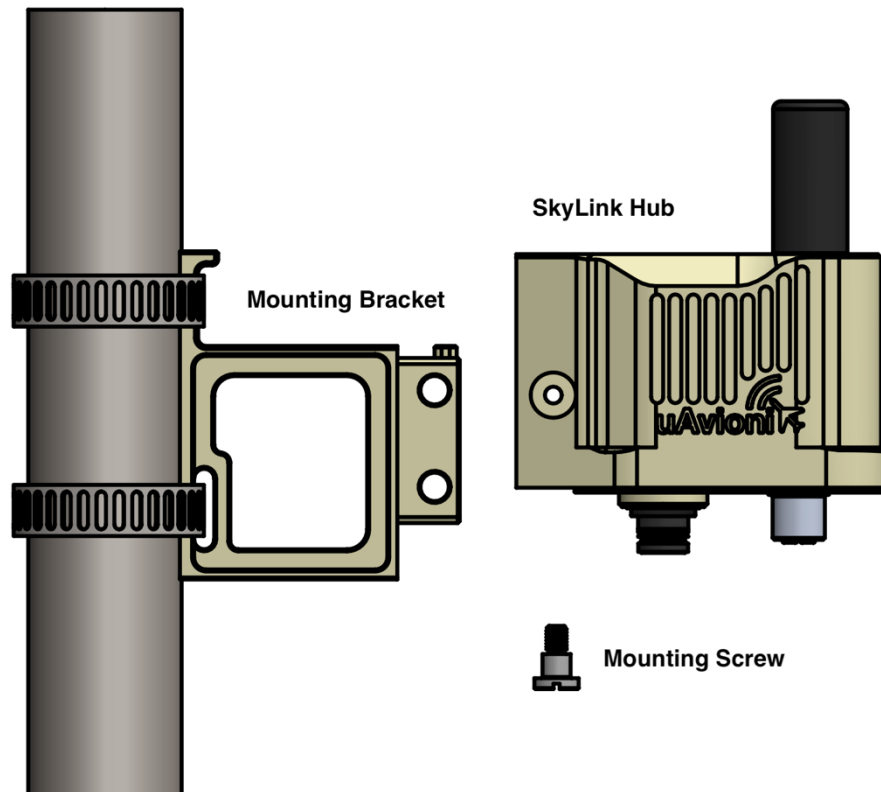
1. Secure the angled SkyStation5060 GRS Mounting Bracket to a pole with the included stainless steel hose clamps.
2. Align the GRS with the Mounting Bracket and slide the GRS into place over the end of the bracket. The bracket will now hold the GRS in place.
3. Use the included mounting screw to fasten the GRS to the bracket.
4. Attach the GRS Directional Antennas, tighten, and adjust orientation.

5. A directional arrow on the end cap of each antenna denotes the transmit and receive direction of the antenna. The antennas have 110 degrees of horizontal sector coverage (55 degrees on either side of the directional arrow). Point *both* antenna arrows in the direction of your operational area for best performance.



*Figure 3 Directional Antenna Orientation*

## 9.1.2 Mounting SkyLink Hub



*Figure 4 Mounting SkyLink Hub*

The SkyLink Hub Mounting Bracket is *not* angled. The Hub mounts perpendicular to the pole, and the GPS antenna should point up. Position the hub away from the GRS to avoid interference.

1. Fasten the Hub Mounting Bracket to a pole with the included stainless steel hose clamps.
2. Align the Hub with the Mounting Bracket and slide the Hub into place.
3. Use the included mounting screw to fasten the Hub to the bracket.

### 9.1.3 Connections

**Ensure that the two directional antennas or RF loads are attached to both RF ports on the SkyStation5060 GRS before powering on.**

Connect SkyStation5060 GRS to the SkyLink Hub and connect the Hub to a POE++ switch with network access.

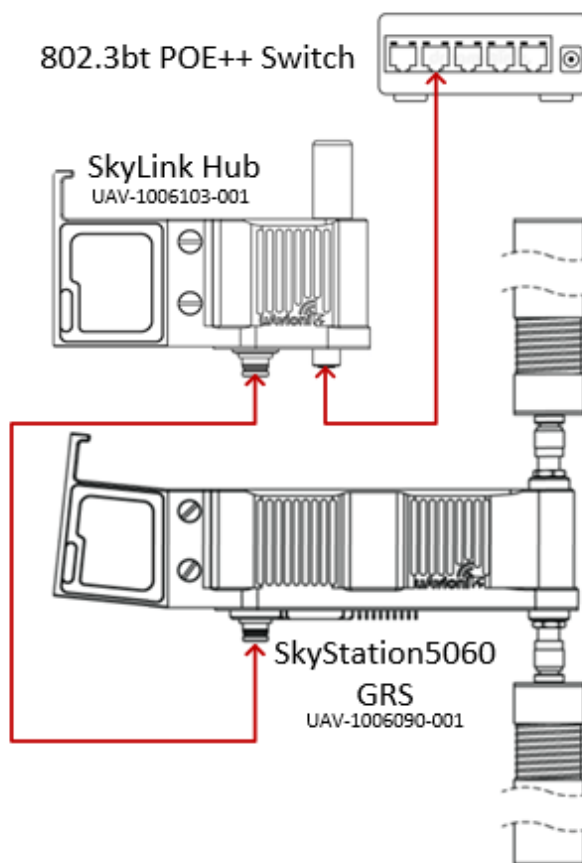


Figure 5 – SkyStation5060 GRS Connections

The SkyStation5060 GRS connects to the Hub with the provided LEMO harness. Table 1 below shows the connector pinout.

Table 1 – SkyStation5060 GRS Pinout

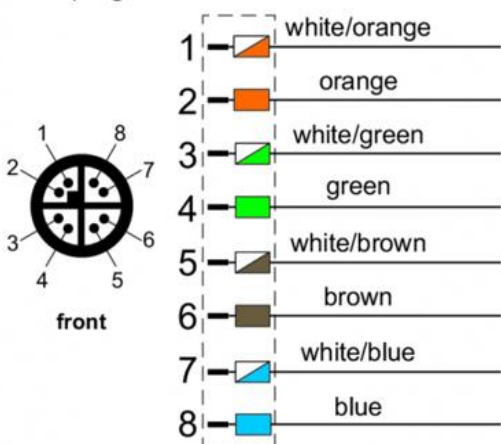
Pin	Type	GRS	Hub	LEMO 1M.308
1	GND			<p>PIN 1</p> <p>PIN 3</p> <p>DETAIL 1</p>
2	NAV	IN	OUT	
3	CTRL RX	IN	OUT	
4	CTRL TX	OUT	IN	
5	PWR	24V	24V	
6	USER RX	IN	OUT	
7	USER TX	OUT	IN	
8	PPS	IN	OUT	

Connect the SkyLink Hub to the network via POE++ using the provided M12 X-Coded ethernet cable.

Table 2 - SkyLink Hub POE Specifications

POE Specifications	
Standard	802.3bt POE++
Maximum Power	60W
Voltage Range	37 – 57V
Maximum Current	350mA
Maximum Cable Resistance	20Ω
Supported Cabling	Shielded Cat 5
Supported Modes	Mode A (endspan), Mode B (midspan)
Power Management	Power Class 6
Maximum Cable Length	100 meters

M12 plug



M12 jack

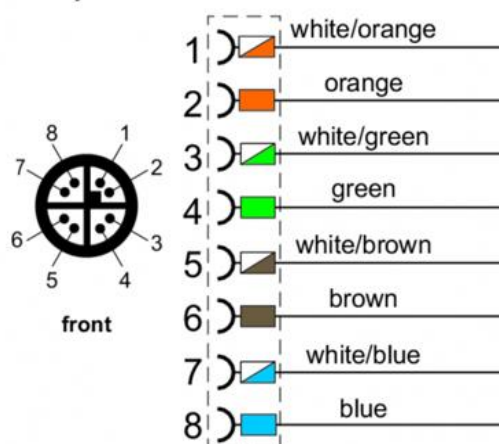


Figure 6 - SkyLink M12 Connector Pinout



### Caution!

**Absolute maximum DC voltage +57 V to the HUB. Higher DC voltage will permanently damage the equipment.**

## 9.2 SkyLink5060 Airborne Radio System (ARS)

**Ensure that the two omni antennas or RF loads are attached to both RF ports on the ARS before powering on.**

### 9.2.1 Mounting SkyLink5060 ARS

Install the SkyLink5060 ARS in the airframe in a location that allows easy access to the autopilot and minimal RF coax length for antenna installation. Ensure ample clearance for the cooling fan in the mounting location.

Install the omni antennas in a vertical orientation on the airframe in a location that reduces shadowing and interference between the omni antenna and the GRS. Ideally one antenna on opposite sides of the airframe. Refrain from installing the antennas near other antennas or other electronic equipment already on the airframe to reduce EMI.

The truFYX GPS needs to be installed on top of the airframe in a location that reduces shadowing and allows a clear view of the sky.

### 9.2.2 Connections

The SkyLink5060 ARS offers seamless integration with the uAvionix George autopilot line, Pixhawk, Piccolo, or any autopilot that has an available RS-232 communication line.

A wire harness is included with the following three terminations (see Figure 7 ARS Wiring Harness):

- **GPS** source for truFYX
- **User** data link for autopilot connection
- **Control** data link for ARS device setup and configuration

24v power source can be supplied through either the User data link or Control data link connector.

Connection to an autopilot is done via the User data link to an available telemetry or serial port. The SkyLink ARS uses RS-232 levels and has a default rate of 57600 8N1

#### George Autopilot

Connection to George autopilot will be made using serial 1 on the autopilots. For more information on George G2i and George G3 pinout, please review the respective manuals at <https://uavionix.com/products/george/>

#### Pixhawk Autopilot

When connecting to a Pixhawk, use the included RS-232 to TTL adapter. Connect the Pixhawk via the User data link. SkyLink must have an external 24v power supply connected through the Control data link as the Pixhawk will not supply 24v.

The Figure below shows each component and its corresponding pinout.

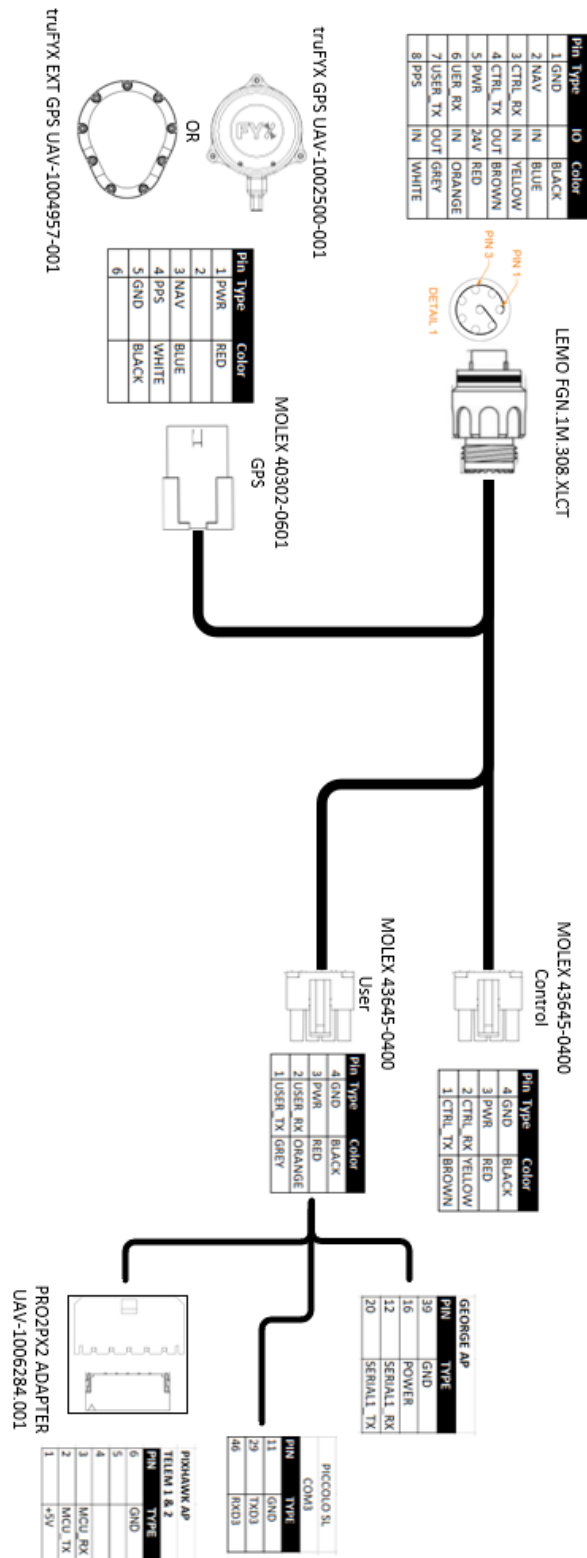


Figure 7 ARS Wiring Harness

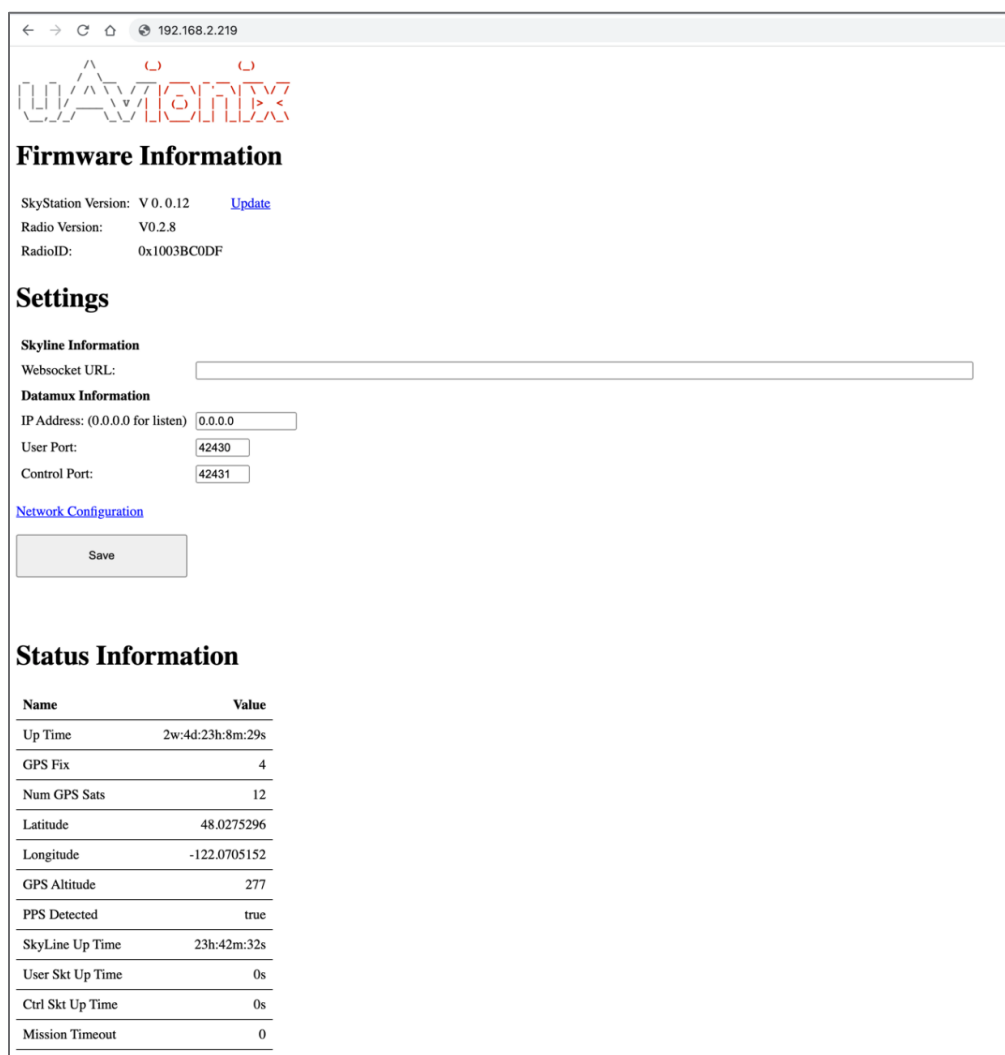
# 10 Configuration

## 10.1 SkyLinkHUB

SkyLink Hub settings are accessed via web browser from a PC or mobile device on the same Local Area Network (LAN) as the powered SkyLink Hub. The IP address assigned by the DHCP server is the base URL. An IP scanner, such as Advanced IP Scanner, can be used to find the IP address of the Hub. MAC addresses are printed on the Hub label.

Navigate to `http://###.###.###.###/`

NOTE: “###.###.###.###” is the IP address of the SkyLink Hub.



The screenshot shows the SkyLink Hub web interface in a browser window. The address bar displays '192.168.2.219'. The page features the 'uAvionix' logo at the top. Below the logo, there are three main sections: 'Firmware Information', 'Settings', and 'Status Information'. The 'Firmware Information' section lists 'SkyStation Version: V 0.0.12' with an 'Update' link, 'Radio Version: V0.2.8', and 'RadioID: 0x1003BC0DF'. The 'Settings' section includes 'Skyline Information' with a 'Websocket URL' field, 'Datamux Information' with 'IP Address: (0.0.0.0 for listen)' set to '0.0.0.0', 'User Port' set to '42430', and 'Control Port' set to '42431'. There is a 'Network Configuration' link and a 'Save' button. The 'Status Information' section contains a table with various system metrics.

Name	Value
Up Time	2w:4d:23h:8m:29s
GPS Fix	4
Num GPS Sats	12
Latitude	48.0275296
Longitude	-122.0705152
GPS Altitude	277
PPS Detected	true
SkyLine Up Time	23h:42m:32s
User Skt Up Time	0s
Ctrl Skt Up Time	0s
Mission Timeout	0

Figure 8 SkyLink Hub Web Page



## Settings

Websocket URL	SkyLine only. Registers the GRS with a SkyLine network.
IP Address	Default 0.0.0.0 sets the GRS Hub to server mode.  A valid IP Address to set the SkyLink Hub to client mode, and the Hub will attempt an outbound connection to the IP Address.
User Port	TCP port for User data link. Default is 42430
Control Port	TCP port for Control data link. Default is 42431

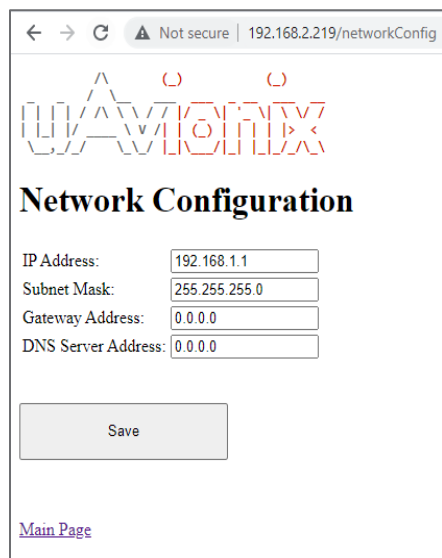
Press the Save button to store the settings changes. These fields are non-volatile and persist through power cycles.

## Network Configuration

*Advanced settings for network administrators.*

On the main Hub settings page, click the “Network Configuration” link under Settings.

The “Network Configuration” settings are only used if the SkyLink Hub is connected to a network without a DHCP server. These settings are ignored in a typical system.



← → ↻ ⚠ Not secure | 192.168.2.219/networkConfig

UAVIONIX

### Network Configuration

IP Address:

Subnet Mask:

Gateway Address:

DNS Server Address:

[Main Page](#)

Figure 9 SkyLink Hub Network Settings

In a network without DHCP, set the IP Address field to assign a static IP to the SkyLink Hub.

Fill in the appropriate values for Subnet, Gateway, and DNS in the network and press Save.

*Note: If you add DHCP to your network or plug the Hub into a DHCP network, these values will be ignored, and the DHCP server will assign values. Using these static network settings within a DHCP network is not supported.*

## Status Information

HUB connection and GPS status is verified in the Status information.

Status Information	
Name	Value
Up Time	5m:15s
GPS Fix	3
Num GPS Sats	10
Latitude	48
Longitude	-114
GPS Altitude	3091
PPS Detected	false
SkyLine Up Time	0s
User Skt Up Time	0s
Ctrl Skt Up Time	0s
Mission Timeout	0

Figure 10 HUB Status

Up Time	Time since HUB has been active on network
GPS Fix	GPS Fix status
Num GPS Sats	Number of GPS satellites being received
Latitude	GPS Latitude
Longitude	GPS Longitude
GPS Altitude	GPS Altitude
PPS Detected	PPS signal detected True or False
SkyLine Up Time	Time since HUB and Radio has been active on skyLine
User Skt Up Time	Time since User data has been active on skyLine
Ctrl Skt Up Time	Time since Control data has been active on skyLine
Mission Timeout	Number of timeouts to create mission on skyLine

## 10.2 SkyStation5060 Ground Radio System (GRS)

Open the uAvionix SkyLinkApp application using a Windows computer with network access to your SkyStation5060 GRS.

Input the IP Address of your SkyLink Hub and the Control Port from the SkyLink Hub Settings page in the “COM Settings” box.

Optionally, next to “Device Name,” type in a name for the radio and press Save. This allows for quick switching between different radio connections.

When the radios are linked, status data is shown for both the local and the remote radios on the “Status tab.”

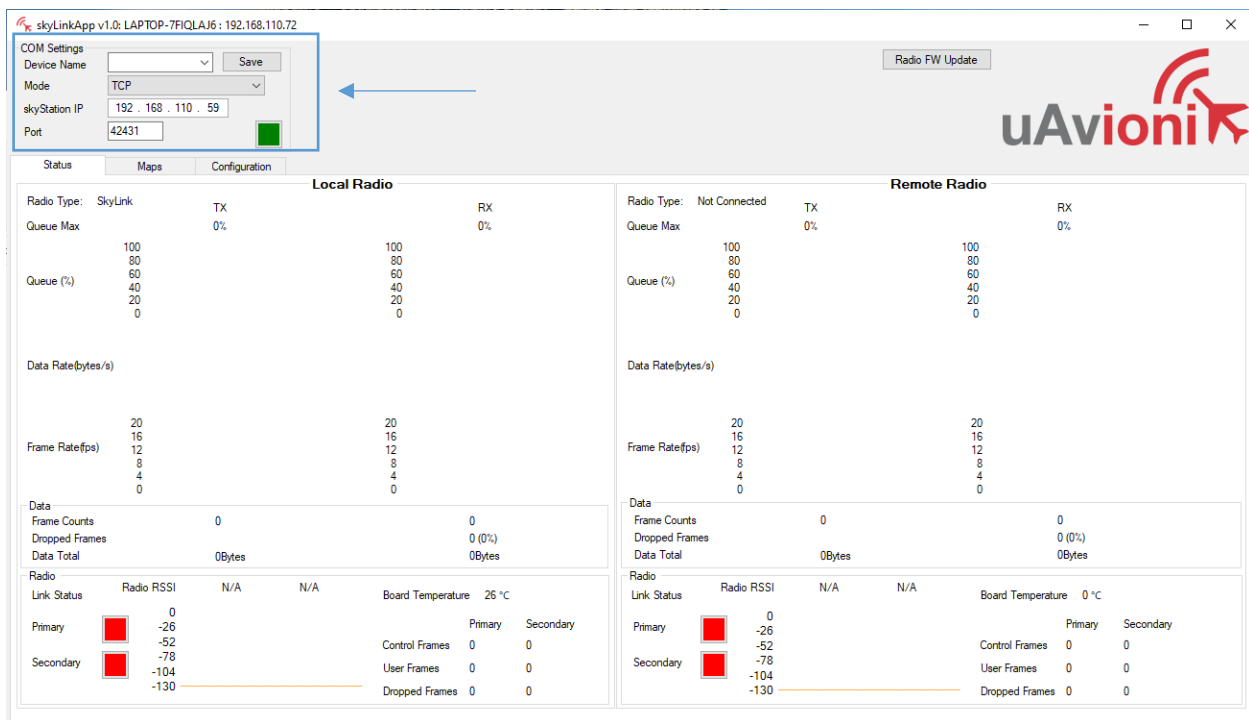


Figure 11 SkyLink App GRS Connection

## GRS Configuration

In SkyLinkApp, navigate to the Configuration Tab. This page is used for device settings and setup as well as selecting the Frequency scheme for the system. The frequency used **MUST** be within 5031 and 5091 MHz.

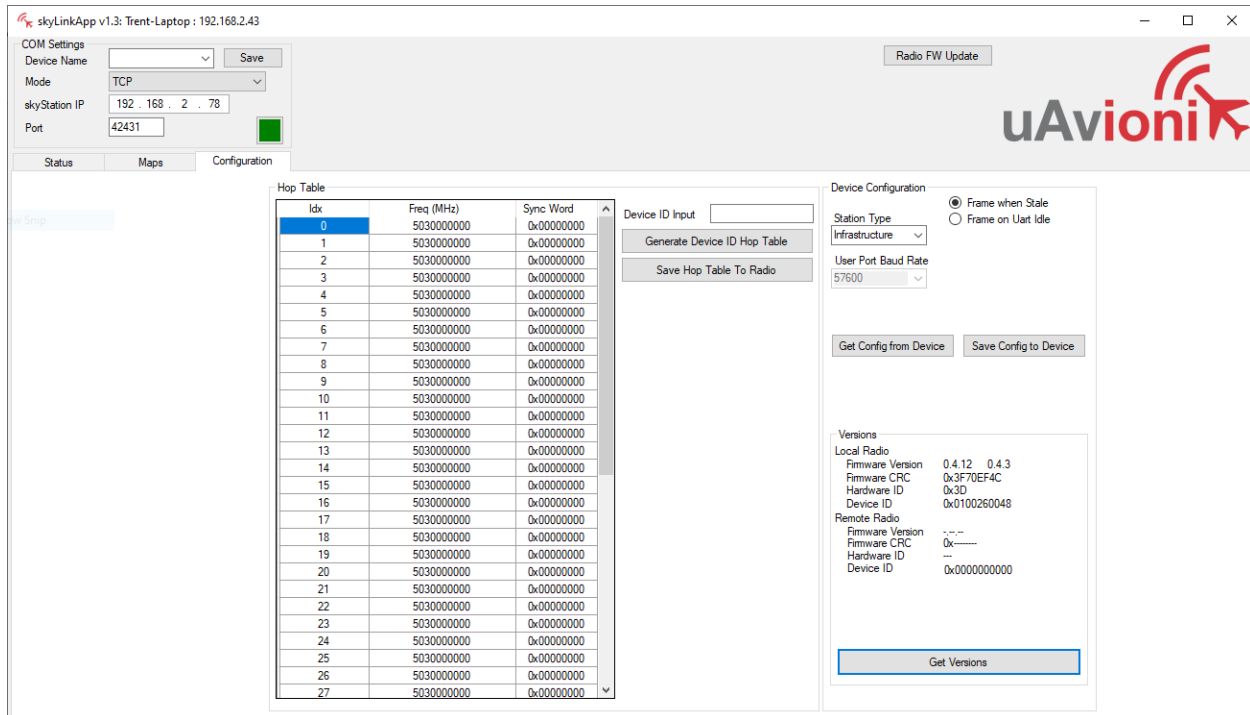


Figure 12 SkyLink App Radio Configuration

Station Type	SkyLink GRS = Ground SkyLink ARS = Air SkyLink GRS with SkyLine = Infrastructure
Hop Table	*Configure radio frequency.
Versions	Get version details from connected SkyLink radios

\*SkyLine will automatically configure a match frequency for the GRS(s) being used with the paired ARS. ARS(s) are assigned a specific frequency and the GRS(s) used must match to create a link. To change the frequency manually, double click the text in the “Freq” of the Hop Table at “Idx” position 0. Then enter your frequency in Hz Ex: 5,056,000,000 Hz. Only configure the top frequency in the Hop Table. Click “Save Hop Table to Radio” to save frequency configuration.

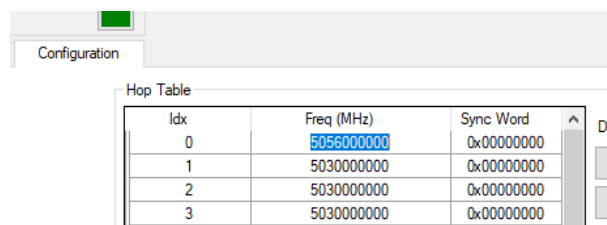


Figure 13 Hop Table

## 10.3 SkyLink5060 Airborne Radio System (ARS)

Connect the ARS Control data link termination to the provided serial connector. Connect the serial connector to a Windows computer.

Open the uAvionix SkyLinkApp application.

In the “COM Settings” box, next to Mode, choose “Serial” then select the “Port” that corresponds with the connected radio (i.e. COM1).

Optionally, next to “Device Name,” type in a name for the radio and press “Save.” This allows for quick switching between different radio connections.

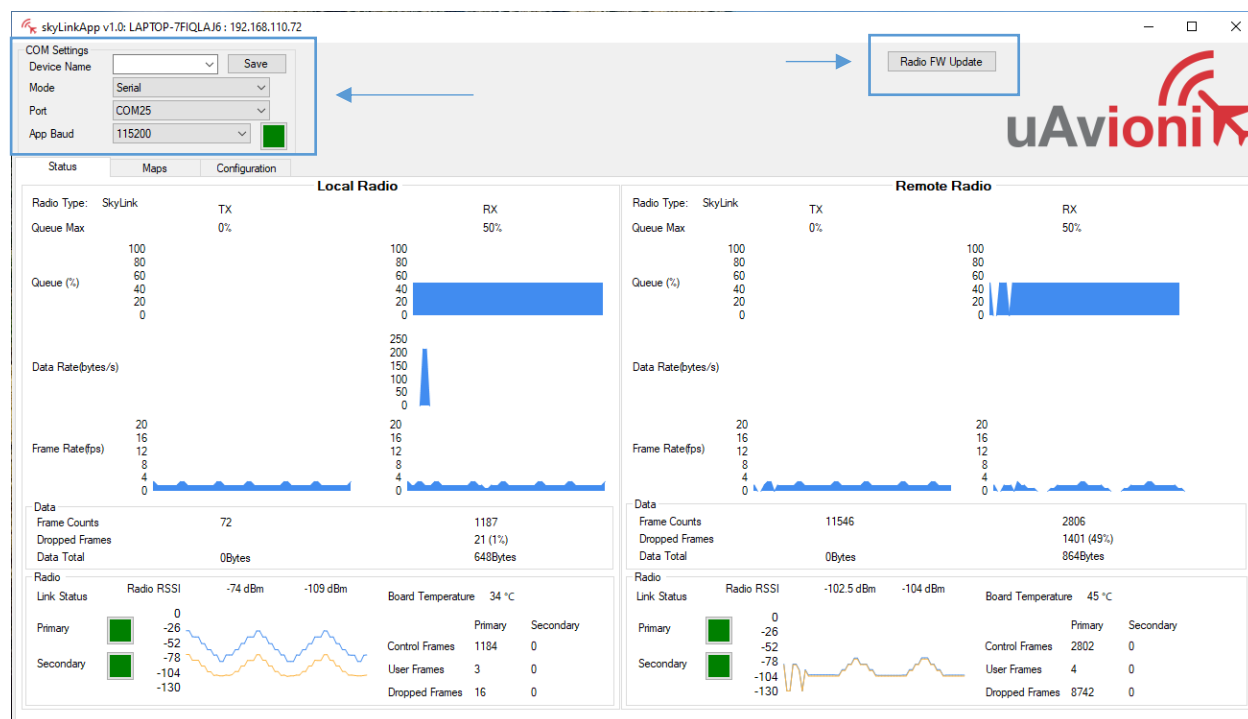


Figure 14 SkyLink App ARS Connection

### ARS Configuration

ARS are delivered preconfigured with an assigned frequency which is provided, and with an airborne configuration. If the frequency of the ARS needs to be adjusted, follow the same steps for configuring the frequency on the GRS in section **Error! Reference source not found.** DO NOT change the station type of the ARS without first consulting uAvionix support. Station type of the SkyLink5060 ARS should ALWAYS be configured to “Airborne.”

# 11 Operation

## 11.1 Radio Link

To link the SkyStation5060 GRS and the SkyLink5060 ARS radios, both need to be configured to the same frequency scheme, have a GPS position lock, and a PPS timing signal.

To verify link, connect the GRS to the SkyLinkApp and go to the Status Tab. When the data arrives, skyLinkApp will begin graphing the radio link statistics.

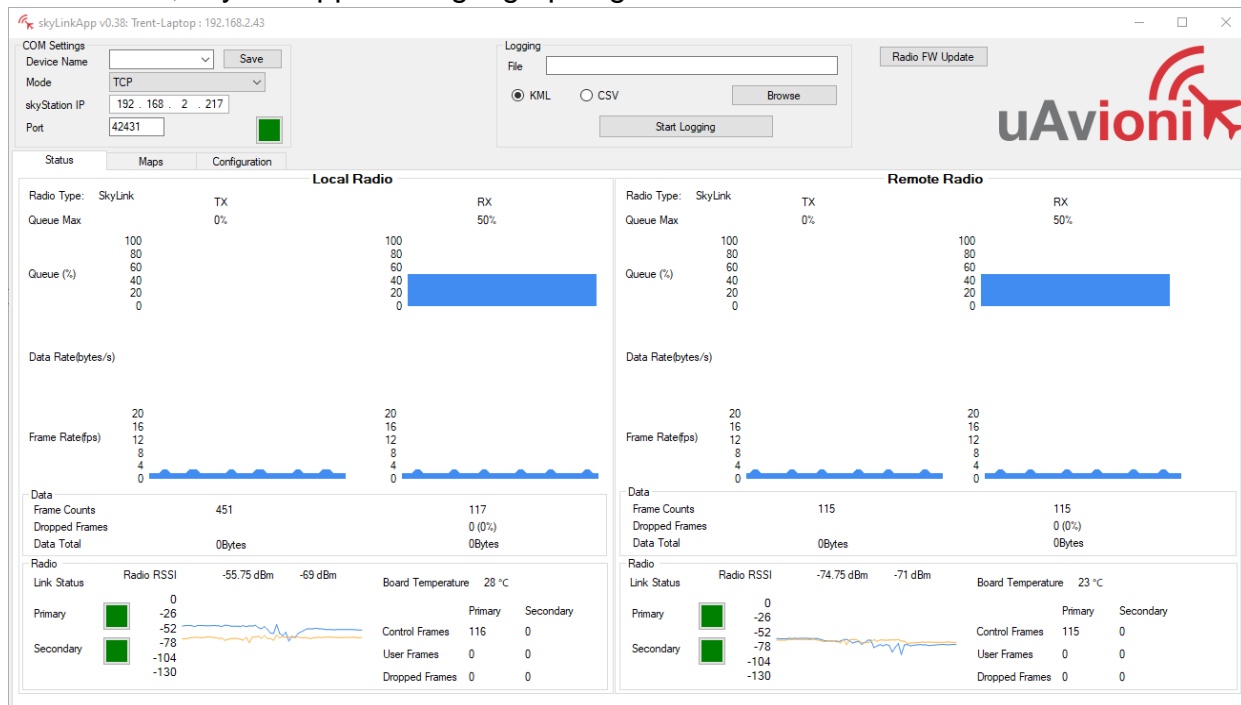


Figure 15 SkyLink App Radio Status

## 11.2 Mission Planner Example

1. Connect the skyLink5060 ARS to an Autopilot via the User data link connection.
2. Verify the ARS and GRS have a link
3. Open ArduPilot Mission Planner application.
4. In the communication drop down menu (upper right corner), select TCP.
5. Press Connect.



Figure 16 Mission Planner Connection

6. Enter the IP Address of the SkyLink Hub. Click OK.
7. Enter the User TCP Port of the SkyLink Hub. Click OK.
8. Mission Planner will connect and display aircraft and telemetry data.

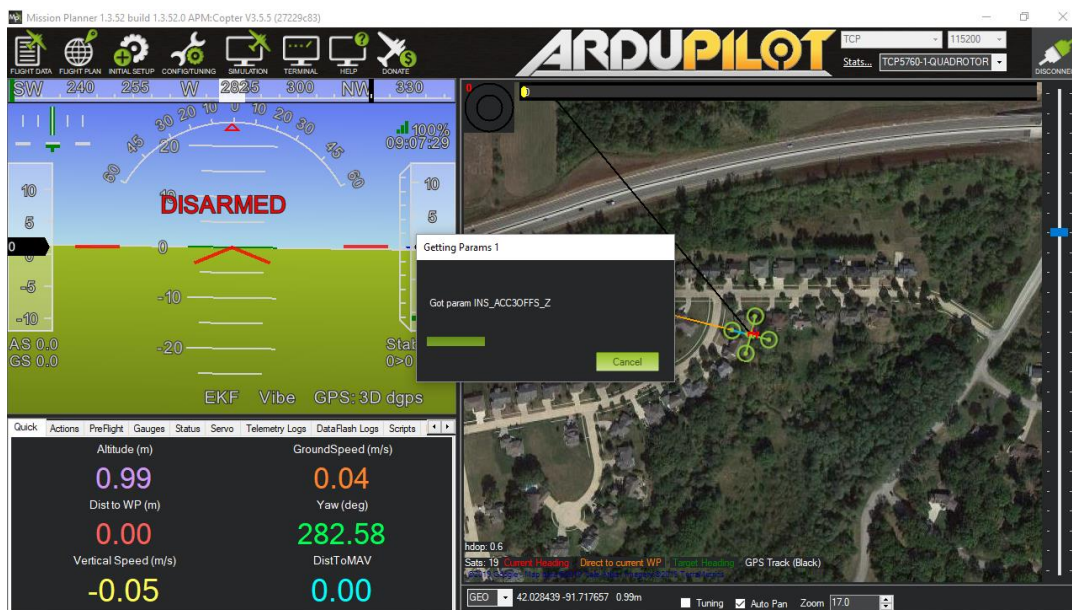
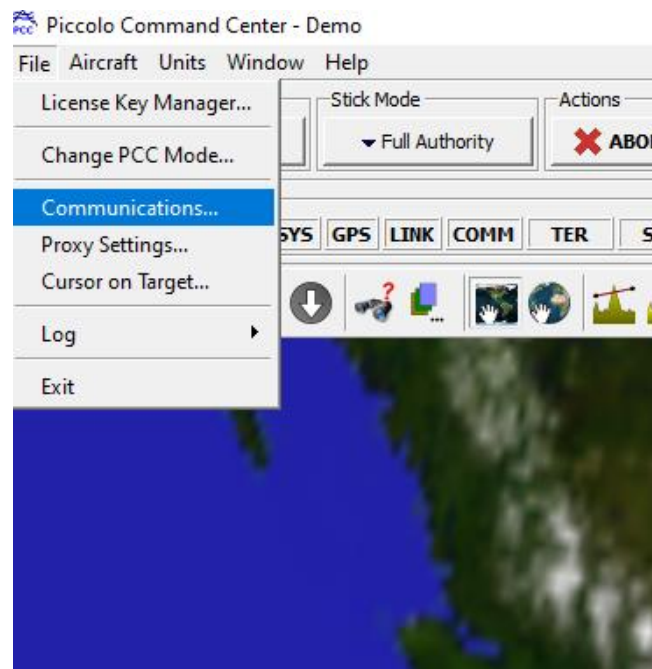


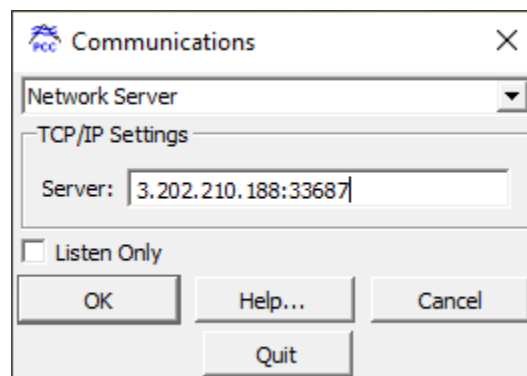
Figure 17 Mission Planner Connection Status

## 11.3 Piccolo Command Center Example (PCC)

1. Open PCC and when the PCC communication pop-up appears, Select “Network Server.” If the communications pop-up does not appear, choose “Communications” from the “File” menu.



2. In the “Server” window, enter the IP address of the SkyLink Hub followed by the User Port separated by a colon. Ex: “XX.XXX.XXX.XX:00000”



3. Press “OK” and verify communication between PCC and the Piccolo Autopilot



## 12 Firmware Update

### 12.1 Hub Firmware Update

Navigate to the SkyLink Hub webpage found in section **Error! Reference source not found..** Hub firmware can be updated by clicking the Update link under Firmware Information.



Figure 18 SkyLink Hub Firmware Update Page

Choose the appropriate file to upload and click Start Update.

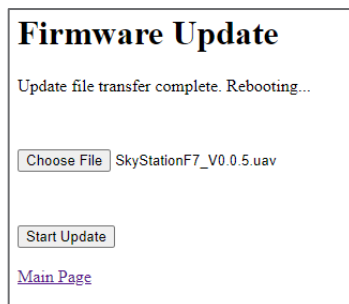


Figure 19 SkyLink Hub Firmware Updating

*Note: The update is canceled if the Hub is powered off or the webpage is closed. Wait for the Hub to reboot before proceeding.*

When the file transfer is complete, click the Main Page link to return to the SkyLink Hub Settings page. The version number on the Configuration Webpage should reflect the firmware version uploaded.

## 12.2 SkyStation5060 GRS Radio Firmware Update

The SkyStation5060 GRS Radio firmware can be updated via the SkyLinkApp.

Connect the GRS to the SkyLinkApp following the steps in section. Press Radio FW Update in the upper right corner of SkyLinkApp. A new window will open.

Press Select File and select the correct firmware file.

Press Connect. When the GRS is connected, the Product Information window will populate with the current radio information and the PingBoot Status in the bottom left will change to "Idle."

Press Flash. DO NOT power off or disconnect the device until the flash is complete.

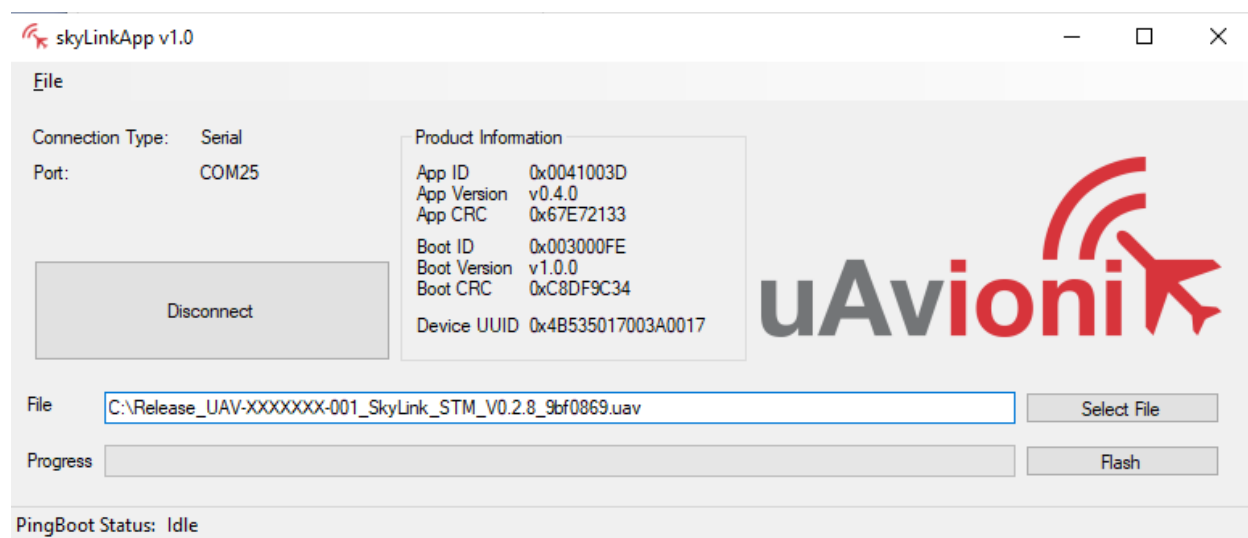


Figure 20 Ping Boot Flasher Application

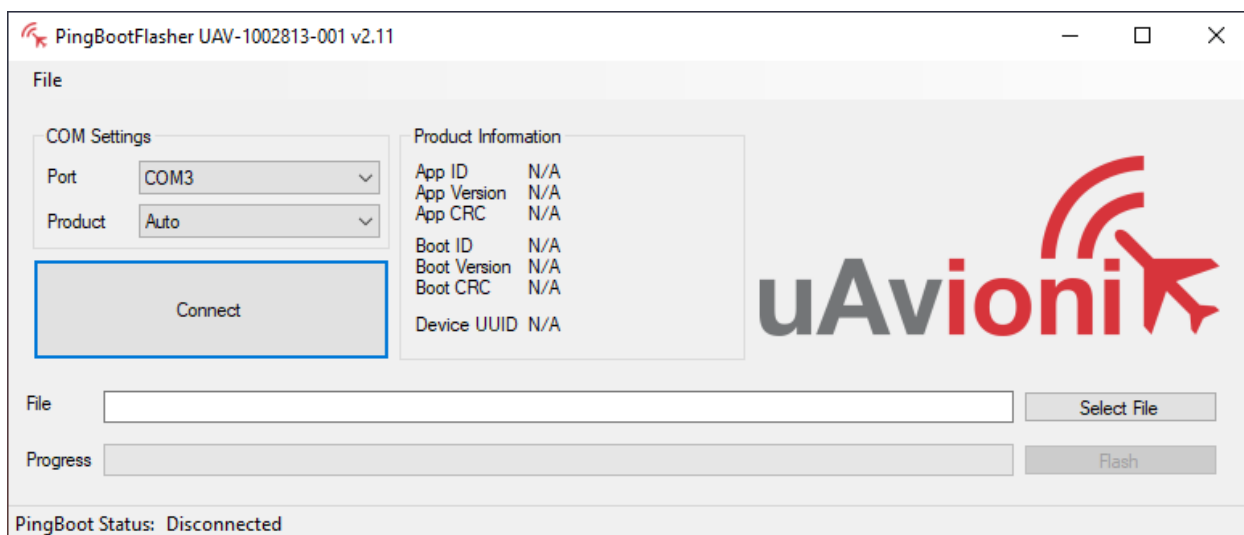
## 12.3 SkyLink5060 Radio Firmware Update

DO NOT POWER ON RADIO WITHOUT ANTENNA OR RF LOADS ATTACHED

The SkyLink5060 ARS firmware is updated using the pingBootFlasher application. Open PingBootFlasher and press Select File and select the correct firmware file.

Connect the ARS via the CTRL port to a PC using the provided serial to USB adapter. Supply 12v of power to the radio.

On the pingBootFlasher application, select the proper COM port from the “Port” dropdown.



Press Connect. When the ARS is connected, the Product Information window will populate with the current radio information and the PingBoot Status in the bottom left will change to “Idle.”

Press Flash. DO NOT power off or disconnect the device until the flash is complete.

## 13 Support

For support visit <https://uavionix.com/support/>