

TheSky Fusion™ User Guide



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S O F T W A R E B I S Q U E

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Introducing TheSky Fusion



Figure 1: TheSky Fusion provides remote access and power to your astronomical equipment.

TheSky Fusion™ marries *TheSky™ Imaging* bundle, the world's single-most capable object-acquisition and imaging software, with exquisitely designed hardware to connect, power and integrate your imaging equipment.

TheSky Fusion™ connects your mount, camera, autoguider, focuser, filter wheel, rotator, dew heater, etc. to TheSky Imaging to control them all from your tablet, smartphone, laptop, or desktop.

Operate your equipment from any modern web browser through Wi-Fi or use a remote desktop application (Remote Desktop or VNC). An Ethernet port even permits a wired network connection for an optimal experience. Though an Internet connection is not required, TheSky Fusion takes full advantage of being on-line when connected to the Web.

TheSky Fusion physically attaches to your mount and simplifies system setup, maintenance, and nightly tasks to maximum your observing productivity. Its flexible power output ports can drive even the most complex hardware configurations. Four high-speed USB 3.0 ports and one legacy serial port can meet most communication needs. If not, one of the configurable 5V DC power output ports can be used to run a powered USB hub (a powered USB hub is recommended) so that you can add additional USB ports.

Photos collected by TheSky Fusion can easily be shared with your desktop or laptop computer so that they can be viewed/analyzed/processed later. TheSky Fusion's built-in computer is very capable of running astronomical equipment and acquiring photos. A primary purpose of TheSky Fusion is to be a reliable image acquisition workhorse. It is not necessarily designed for or intended for *intensive image processing* which can be performed after acquisition on a different computer.

This document focuses on setting up TheSky Fusion, connecting devices, powering hardware, and establishing the remote connection to TheSky Imaging . TheSky Imaging User Guide describes its features and capabilities which are outside the scope of this document. A *printed* version of the 800+ page printed version of TheSky Imaging is not included, but the portable format document (PDF) version can be downloaded by logging in to www.bisque.com and navigating to **Products > TheSky Imaging > Documentation** tab.



TheSky Fusion and TheSky Imaging should be ready to use, out of the box. As tempting as it might seem, please do not make changes to the computer's operating system before using it.



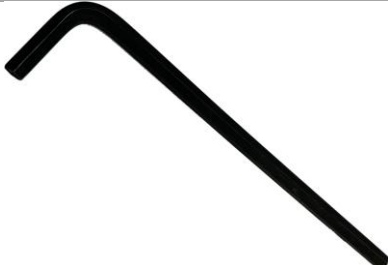

For example, turning off the computer's **Enable Wi-Fi** option will prevent wireless connections and cause frustration.



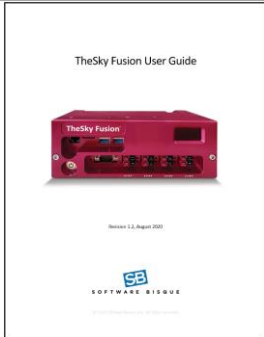
Serial Number Registration

Visit www.bisque.com/register for instructions how to get your TheSky Fusion registered. As this is a manual process, please allow 2-3 business days to process the registration request. Thanks for your patience. In the meantime, you can download the latest patch by logging into the Software Bisque website, then clicking **Support > TheSky Fusion**. Read *TheSky Fusion Updates and Change Log* post (the first one) to download the patch.

Packing List

The table below lists the components included with TheSky Fusion. Please contact Software Bisque if anything is missing.

TheSky Fusion Packing List		
Qty	Photo	Description
1	 A red rectangular device with a black antenna on top. The front panel features a display screen and several buttons. The text "TheSky Fusion" is printed on the front.	<p>TheSky Fusion</p> <p>Shipping Box Specifications</p> <ul style="list-style-type: none"> • Total weight: 3.2 kg (7 lbs.) • Dimensions: 25.4 cm x 20 cm x 13 cm (10 in. x 8 in. x 5 in.) <p>The dovetail is mounted to the top of TheSky Fusion during shipping as shown.</p>
1	 A yellow T-handle hex wrench with a silver metal shaft.	5/32-in. T-handle hex wrench
1	 A black hex wrench with a bent handle.	3/16-in. hex wrench
1	 A black rectangular device with a red and black plug on one side and a digital display on the other. The display shows "12.0" in red.	<p>TheSky Fusion DC Voltage Tester</p> <p>This handy tool provides peace of mind when powering your direct-current devices from a power out port. <i>Before plugging the actual device, plug this testing in to the destination power output port confirm the output voltage is what you expect.</i></p>

TheSky Fusion Packing List		
Qty	Photo	Description
		This tester measures DC voltage, only. Never attempt to use it to measure voltage from an AC power source.
1		<p>TheSky Fusion Power Input Cable</p> <ul style="list-style-type: none"> • 0.9 m (3 ft) long • Powerpole to Powerpole connectors <p>To use this cable with third-party power supply units. If necessary, connectors from one end can be removed, the leads stripped to expose the copper wires so that they can be connected to a regulated 12V DC power supply with positive and negative lead connection points.</p>
1		TheSky Fusion Quick Start Guide
1		TheSky Fusion User Guide

Hardware Overview

Front View

Figure 2 and the tables below describe each TheSky Fusion component.




Figure 2: TheSky Fusion's external components.

For a description of each component, match the number in Figure 2 with the Number column in the table below.

Number	Description	Number	Description
1	12V/3A DC or 5V/1.5A DC fused power out port (set using switch on PCB, see page 42).	15	System power button.
2	12V/3A DC or 5V/1.5A DC fused power out port (set using switch on PCB, see page 42).	16	RJ45 Ethernet port.
3	12V/3A DC fused power out port.	17	HDMI port.
4	12V/5A DC fused power out port.	18	Four USB 3.0 ports.
5	12V/5A DC fused power out port.	19	Four-line OLED display.
6	12V/7A DC pulse-width modulated (PWM) fused power out port.	20	Wi-Fi antennae.
7	12V/7A DC PWM fused power out port.	21	1/4-20-in., 60 mm-spaced dovetail mounting holes.
8	8V/3A DC or 5V/3A DC fused power out port (set using switch on PCB, see page 42).	22	GPS antenna (internal).

Number	Description	Number	Description
9	TheSky Fusion’s power status LED.	23	External GPS antenna port (optional).
10	Male DB9 RS -232 serial port.	24	Power input port (12V/40A DC), specified below.
11-14	Power output port status LEDs.	25	TheSky Fusion serial number and identifier.

Component	Explanation
Power button	<p>The power button does not operate like a traditional on/off switch.</p> <ul style="list-style-type: none"> • TheSky Fusion is booted each time the external power cable is plugged in. In this case, there is no need to click the <i>power on/off button</i>. The boot process takes about one minute before TheSky Imaging is ready to use. • When the unit is powered on and initialized, pressing and releasing the power button initiates the unit’s shut down procedure and then turns the power off. • Power can be restored by either plugging the external power cable or pressing and releasing the power button. <p> Always power down TheSky Fusion by pressing and releasing the power button!</p> <p>Unexpected loss of power, for example, from unplugging the power supply, can cause file corruption and data loss.</p>
Power input port	<ul style="list-style-type: none"> • A power cable that ends with a Powerpole connector is required to power to TheSky Fusion’s power input port (24).
Power output ports	<ul style="list-style-type: none"> • The power port numbering sequence shown in the diagram matches the order on TheSky’s <i>Power Control</i> window (shown below). • Ports 6 and 7 can be configured to provide power using pulse-width modulation (PWM) for dew heaters. • The power out ports are turned off by default. Use TheSky Imaging’s Power Control to turn the devices on and off, configure the external LED status, power port startup state, and pulse-width modulation settings.

Rear View



Figure 3: TheSky Fusion rear view with components numbered.

Power In Port (12V at 40A Max)

If you purchased a TheSky Fusion power supply unit (PSU), plug it into the mains power supply and plug the Powerpole connector into the **Power In** port. Custom PSUs must supply 12V DC, with up to 40 amps maximum (480W max). The supplied Powerpole to Powerpole cable is intended to be adapted to a power supply unit that accepts bare wire leads for power output.

Wi-Fi Antenna

The Wi-Fi antenna is located on the back of the case. For best performance, rotate the antenna vertically (Figure 3). Rotate the antenna horizontally to prevent damage during transport.

GPS Antenna

The built-in GPS antenna is located inside the extruded black portion of the case, outside the aluminum housing.

Optional GPS Antenna Port

The optional GPS antenna port can be used to connect an external GPS antenna for greater signal, for example, when TheSky Fusion is used inside a dome. External GPS antennas are sold separately.

Bottom View



Figure 4: TheSky Fusion external housing, bottom view.

Power Output Port Description Text

The voltage and amperage for each power output port are etched into the bottom of TheSky Fusion housing to provide a convenient reference and reminder so that you can be sure you are using the correct port before plugging in your equipment.



Please exercise great caution when plugging in your equipment to TheSky Fusion's power output ports!

Your equipment can be irreparably damaged if the power output port is configured to supply a voltage that is not compatible with your hardware.



Power Output Disclaimer: Software Bisque is not responsible for damage to equipment caused by applying the incorrect voltage. Always verify the voltage of each power output port by plugging the TheSky Fusion DC Voltage Meter into the port before actually plugging in the device.

The voltage, and maximum amperage supplied by ports 1, 2, and 8 are configurable. See "Appendix A: Power Out Port Configuration" on page 42 for details how to change them.

Ports 6 and 7 are pulse-width modulated (PWM). Pulse-width modulation is a mechanism that allows power to be supplied periodically to the dew heater. You want enough power to remove dew, but not so much power as to introduce thermal currents and noise at the image plane.

Threaded Mounting Holes

TheSky Fusion is normally shipped with the dovetail plate attached to the top of the housing with four mounting bolts.

The six threaded mounting holes on the bottom of the housing can also be used to attach the dovetail in any of the three different positions. Note that two bolts are sufficient to securely attach the dovetail plate and four may be overkill.

Attaching TheSky Fusion to the Telescope



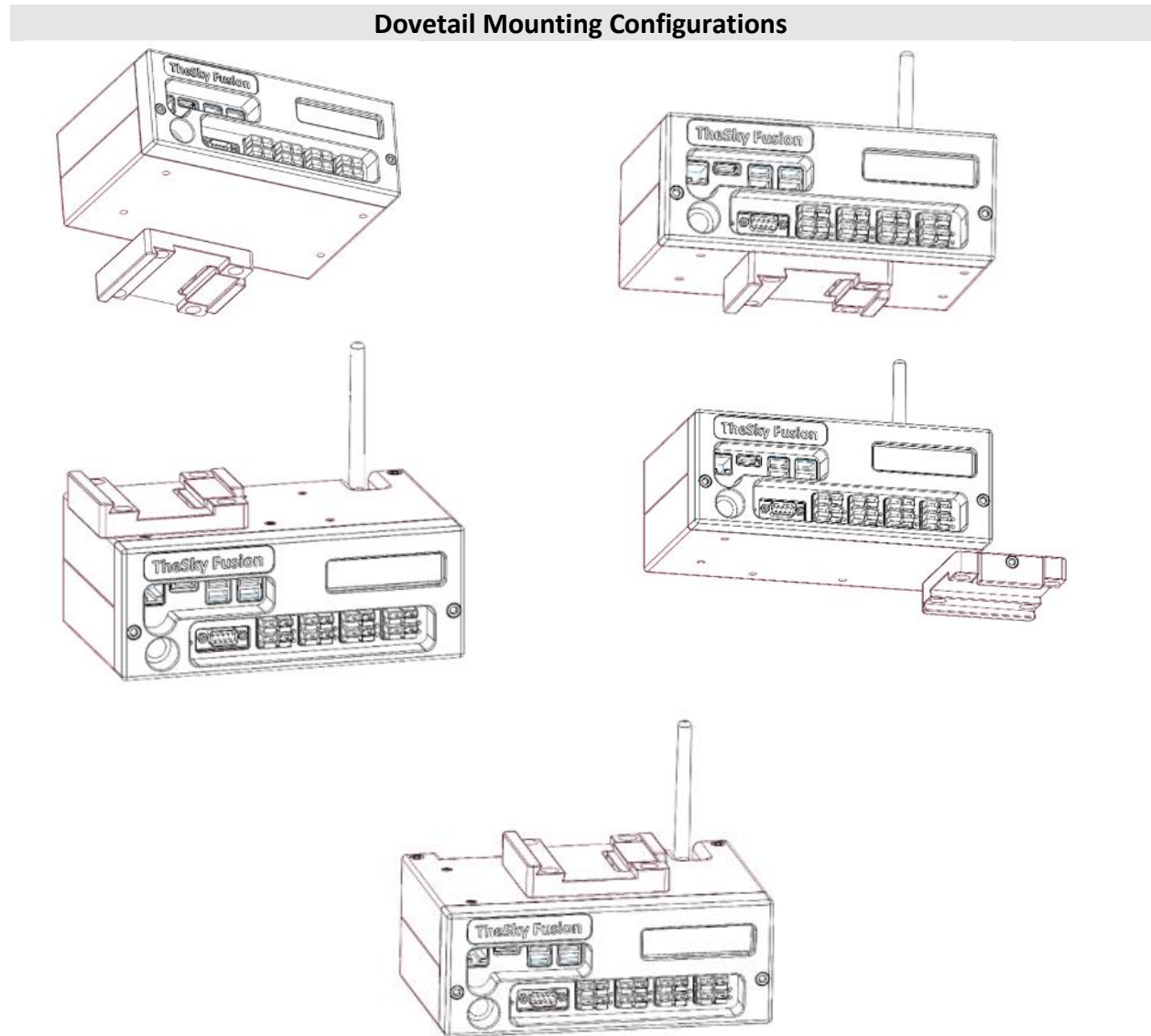
Figure 5: TheSky Fusion attached to a refractor's OTA mounting rings.

TheSky Fusion is intended to be attached to top of the telescope mount along with the telescope to minimize the number of cables run through, or on the exterior of the mount.

TheSky Fusion includes a dovetail saddle that incorporates both the Losmandy and Vixen (D and V Series, respectively). TheSky Fusion's aluminum shell has mounting holes on both the top and bottom to offer a variety of mounting options. Additionally, the dovetail saddle's ¼-20 threaded

holes are spaced 60 mm (2.36-in.) apart and compatible with many third-party dovetail bars and saddles to suit a wide range of equipment configurations.

The table below shows several dovetail mounting configurations.



Wiring TheSky Fusion

At a minimum, TheSky Fusion requires two cables to run through or along the outside of the telescope mount:

- A 12V DC power supply cable to power TheSky Fusion and supply DC power to your equipment through TheSky Fusion’s built-in power output ports.
- USB (or RS232) cable for mount control

An optional ethernet cable can be run to have a physical connection to the local network.

The 12V DC power cable requires an Anderson Powerpole connector that plugs into TheSky Fusion’s power input port.

Power can be supplied to TheSky Fusion by:

- An 11.5A or 21A 12V DC power supply units (sold separately). Software Bisque offers two “officially tested” models on the Software Bisque Store.
- TheSky Fusion Battery Adaptor with an EGO™ Lithium-ion battery (sold separately).
- A user-supplied 12V AC to DC power supply unit or 12V DC battery.



TheSky Fusion warranty does not cover damage caused by the application of incorrect power source power supply solutions.

These cables can be run through the Paramount mount; for non-Paramount mounts, please reference the manufacturer’s instructions regarding running cables for instrumentation.

Ultimately, a 12V DC power source must be supplied to TheSky Fusion, a connection established from the mount’s control system’s USB or RS232 port to TheSky Fusion and, optionally, an Ethernet cable connected to TheSky Fusion’s Ethernet port.

Connecting Communication Cables to TheSky Fusion

Equipment that communicates with TheSky Imaging via USB communication can be connected to one of the four USB 3.0 ports located on TheSky Fusion’s front panel. If more ports are required, consider adding an optional four-port powered USB 3.0 hub (sold separately).

A RS232 serial device can be connected to TheSky Fusion’s DB9 port.

By default, all eight power outputs are configured to supply 12V DC power. Please refer to the specifications etched onto the bottom of TheSky Fusion’s face plate for specifics of how much amperage and what alternative voltages and features each power output can provide.

As a general guideline, high amperage devices (large format cameras, dew heaters, etc.) should be connected to outputs 4-7, and lower power devices can be connected to any power output. Ports 1 and 2 can be configured for 5V, 6 and 7 can be used as simple dew heater controllers, and port 8 can be configured to power DSLR or mirrorless system cameras.

Passwords

You must enter passwords to access the following features:

- The Wi-Fi access point
- To remotely access TheSky Fusion from VNC
- Allow remote access to TheSky Fusion's shared folder and other administrative account (super user) command access.

Feature	Username	Password
Wi-Fi access point	n/a	12345678
Web browser access	n/a	12345678
VNC access	n/a	fusion
Shared folder access	admin	fusion

Use TheSky Fusion Settings application on TheSky Fusion desktop to change the Wi-Fi and VNC password.

Connecting

TheSky Fusion turns on automatically when power is connected. If TheSky Fusion is powered on, the power button will turn it off. If TheSky Fusion is plugged in, and powered off, because it was shut down, the power button will power it back on.

Once TheSky Fusion is powered on and the external screen displays **Ready**, you may connect to the Wi-Fi network and then control it in any of three ways:

- A web browser
- A virtual network computing (VNC) app
- From TheSky HD iOS app

The Wi-Fi network, by default, is named **TheSkyFusion-XXXXXX** where XXXXXX represents the last six characters of TheSky Fusion's Ethernet Mac address.

Web Browser

1. From your smartphone, tablet, laptop, or desktop computer, join TheSky Fusion's Wi-Fi access point.



This step is very easy to forget when getting started each session. Your computer must be connected to TheSky Fusion's Wi-Fi access point before proceeding. If the tablet, smartphone, or computer is not connected, remote access to TheSky Fusion's desktop is not possible.

iOS

- a. Tap **Settings > Wi-Fi > Other Networks > TheSky Fusion-XXXXXX**. The first-time connection requires entering the Wi-Fi access point password, subsequent connections do not (and TheSky Fusion's network is listed under **My Networks** on the Settings window.) A green checkmark appears next to the network name when successfully connected.

macOS

- a. Click **Apple > System Preferences > Networks > Wi-Fi > Network Name > TheSky Fusion-XXXXXX**. The first-time connection requires entering the Wi-Fi access point password.

Alternatively, when the **Network** option **Show Wi-Fi Status in Menu Bar** checkbox is turned on, click the Wi-Fi graphic in the Menu Bar to list the available Wi-Fi access points, and select TheSky Fusion's access point to join.

Windows

- a. Click **Start > Settings > Network & Internet > Wi-Fi > Show Available Networks** **or** click the Internet Access icon in the menu bar.
- b. Highlight or tap **TheSky Fusion-XXXXXX** and click **Connect**.

The device is now connected to TheSky Fusion's access point.

2. Open your web browser of choice.
3. In the browser's address bar, enter **theskyfusion.local**.
4. Login to TheSky Fusion using the default Wi-Fi network password from table above.

VNC App

Software Bisque recommends VNC Viewer by VNC Connect as we have validated and tested it on multiple platforms.

To download the VNC Viewer app visit the URL below or scan the QR code in Figure 6.

<https://www.realvnc.com/en/connect/download/viewer/>



Figure 6: Scan this QR Code to visit the RealVNC Viewer web page.

1. Connect to TheSky Fusion's Wi-Fi network.
2. Run VNC Viewer.
3. Go through the tutorial if you have not used the app before.
4. On iOS or Android, click the **+** button. On Linux, macOS, or Windows, click **File > New Connection**.
5. Enter the hostname (default: `theskyfusion.local`) or IP address (default: `192.168.42.1`) in the **Address** field on iOS or Android or the **VNC Server** field on Linux, macOS and Windows.
6. Enter a descriptive name for the connection in the **Name** field.
7. Tap or click **OK**, **Create**, or **Save** to confirm the input.

Warning messages related to an unencrypted connection can be safely ignored as the ad hoc Wi-Fi network connection is secure.

8. Enter the **Password** (default: `fusion`) and feel free to have the app save the password.

From now, just tap or double click on the icon for TheSky Fusion in the VNC app and enter the password, if prompted, to connect.

Transferring Images from TheSky Fusion

A good practice after collecting photos is to save them to your desktop computer. There are a several different methods for transferring images from TheSky Fusion to your image processing machine.

- Plug a USB flash drive or SSD into one of TheSky Fusion's USB ports, then copy the images from the desktop folder named **ImageRuns** to the external drive.

Note that you can configure TheSky Imaging to automatically save images to this folder. To do so, from TheSky, on the **Camera** window, click the **AutoSave** button then click the

Choose AutoSave Folder's Choose button. From the **Choose Autosave Folder** window, under **Look In**, click **Admin > ImageRuns** and click **Choose**.

- Connect to the **ImageRuns** folder using a network share and copy the images from this folder to your image processing computer.
- If you are connected to the Web, run the Firefox web browser, log in to your favorite file sharing service, and copy the files there.

Transferring Files to a Mac

1. Click **Apple > System Preferences > Network** and click the **Turn Wi-Fi On** button if necessary. Expand **Network Name** and choose **TheSkyFusion-XXXXXX** to join this network. Enter the password **12345678** and click **Join**.
2. From Finder, click **Go > Connect to Server**.

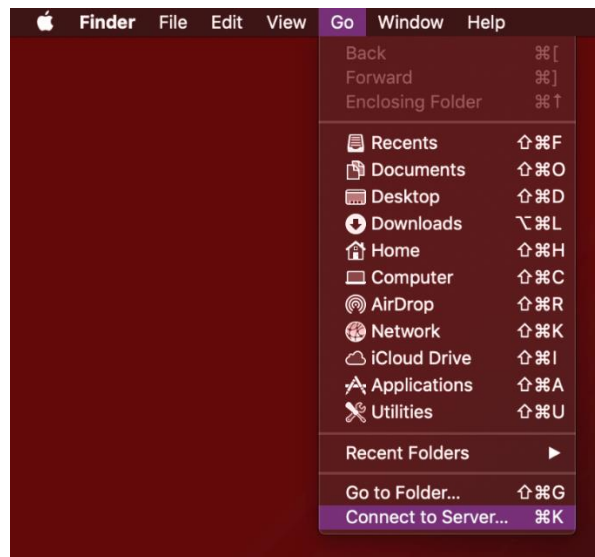


Figure 7: The **Connect to Server** command on macOS Finder.

3. Enter the IP address of TheSky Fusion; the default IP address is shown in Figure 8 and click **Connect**. When prompted, click **Connect** again to verify that you want to connect to this server. If TheSky Fusion is connected to an infrastructure network, use the IP address assigned by the DHCP service.

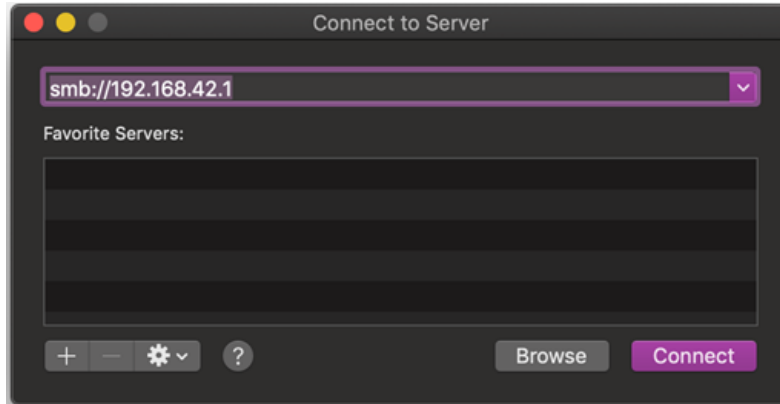


Figure 8: Connecting to TheSky Fusion using its IP address.

4. Enter the username and password. The default username is **admin** and the password **fusion**. Click **Connect** to proceed.

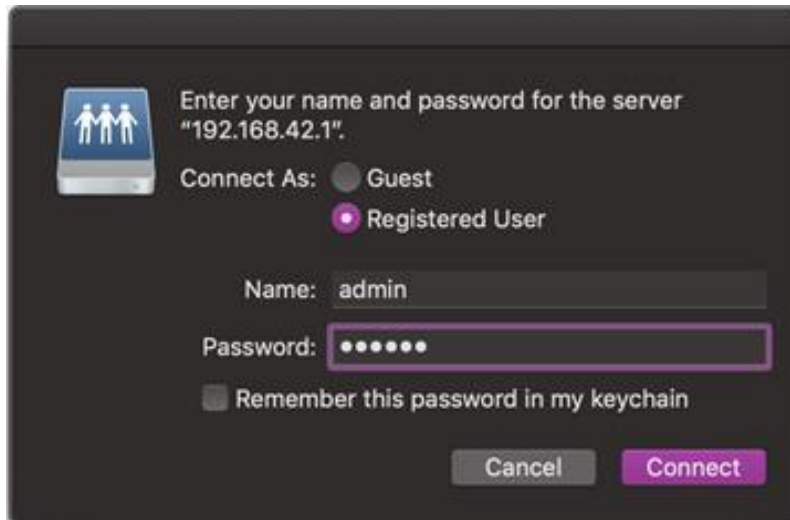


Figure 9: Enter the name and password to connect to TheSky Fusion from macOS.

5. On the next window, click **OK**.

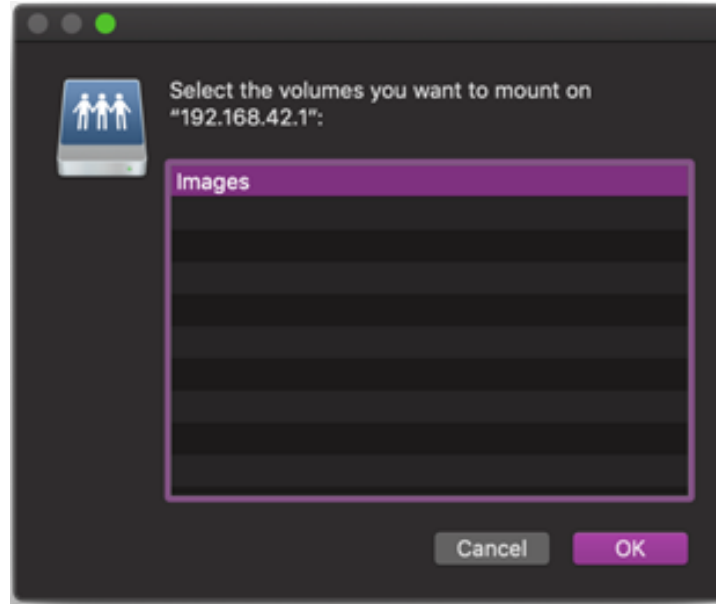


Figure 10: Choose the name of TheSky Fusion's volume to mount.

TheSky Fusion's **ImageRuns** folder now mounted and is shown under **Locations** in the Finder sidebar. Your images can be copied from this folder to anywhere on your computer.

Transferring Files to Windows

To share files between TheSky Fusion and a Windows computer:

1. In the Windows Search bar, enter **Wi-Fi Settings** and click the magnifying glass or press **<Enter>**.
2. On the Wi-Fi **Settings** window, Turn **Wi-Fi** on.
3. Click **Show Available Networks**.
4. Click **TheSkyFusion-XXXXXX** (the example below shows TheSkyFusion-424E71) and click **Connect**.

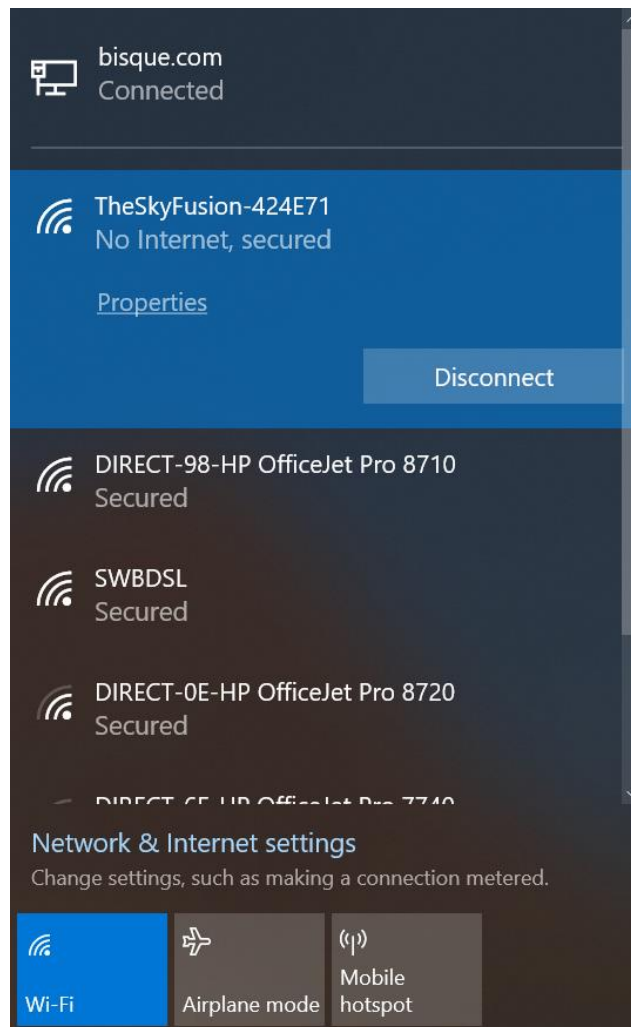


Figure 11: Windows 10 available networks.

5. When prompted, enter **admin** for the **Name**, **12345678** for the **Password** and click **OK**.
6. Right-click the **Desktop** then click **New > Shortcut**.
7. On the **Create Shortcut** window, Under **Type the Location of the Item**, enter **\\TheSky Fusion's IP address\ImageRuns**. The default IP address is: [\\192.168.42.1/Images](http://192.168.42.1/Images).

TheSky Fusion's shared folder is now displayed on the Desktop.

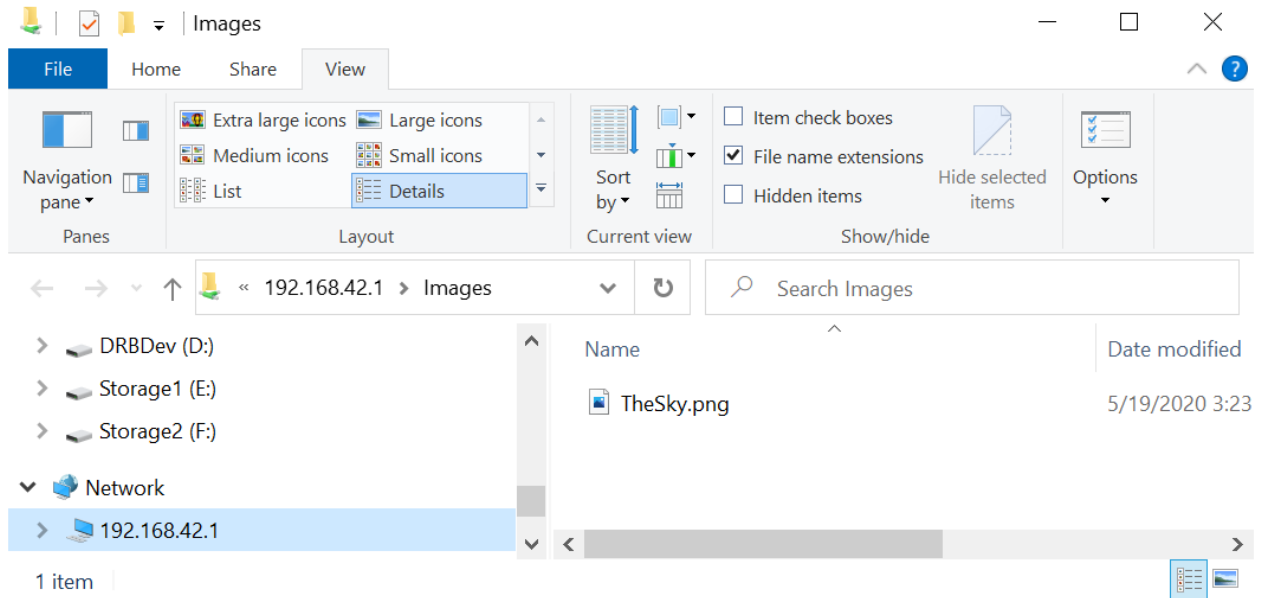


Figure 12: TheSky Fusion shared folder on Windows.

Troubleshooting Windows File Sharing

Windows caches network connection information, so that attempting to share files from a second TheSky Fusion on a single machine may result in the following error message.

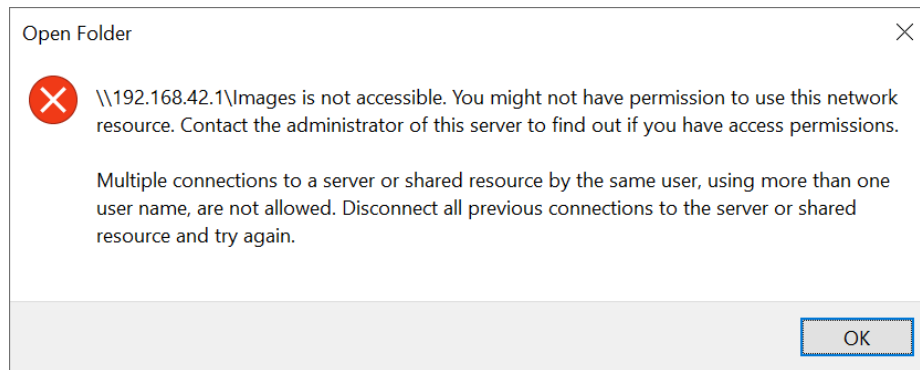


Figure 13: Error message when attempting to connect a second TheSky Fusion to a Windows 10 computer.









The solution is to restart the computer to remove the cache before connecting to TheSky Fusion's shared folder.


TheSky Fusion Desktop



Figure 14: TheSky Fusion desktop.

Figure 14 shows TheSky Fusion Desktop. The Desktop shortcuts include:

Icon	Description
	The Home folder is like the Windows Documents folder. It stores the Desktop, Documents, Downloads, and other folders commonly used to store files.
	The operating system's boot SSD; accessible to system administrators (the "super user") only.
	Launch TheSky Imaging.
	Launch TheSky LTI in a windowed view.
	Launch TheSky LTI in full screen mode.
	This folder can be accessed by other devices to transfer files, such as photos acquired with TheSky Fusion (page 18).
	Launches TheSky Fusion Settings application (page 25).
	Shortcut to TheSky Fusion User Guide.

Icon	Description
	Shortcut to the 256 GB SSD. This storage contains about 95 GB of the large and small optimized Gaia star catalogs. The remaining free storage can be used to save your data (astronomical photos, etc.)

TheSky Fusion Configuration Settings

TheSky Fusion *Settings* application icon is located on the Desktop. This application lets you set administrator-level options including TheSky Fusion’s startup, security, networking, system time zone, OLED display settings, and installing updates to TheSky Imaging bundle, equipment device drivers and other system-specific software.

Double tap the **Settings** icon on TheSky Fusion Desktop to launch **TheSky Fusion Configuration** application.



Figure 15: Double-click TheSky Fusion Settings icon to launch the app.

Startup Tab

The **Startup** tab (Figure 16) lets you configure what software is launched each time TheSky Fusion is powered on. You can also set the resolution of remote screen and the system’s time zone.

Autostart on Boot Options

The **Autostart on Boot** options let you configure what applications are launched each time the computer is turned on.

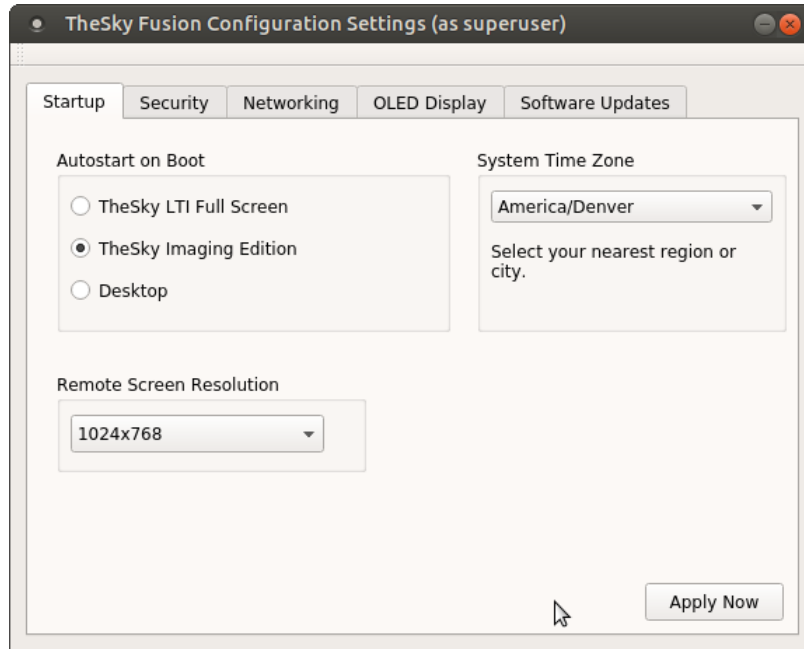


Figure 16: TheSky Fusion Configuration Settings.

- **TheSky LTI Full Screen:** TheSky LTI's window is sized to occupy the entire screen.
- **TheSky Imaging:** The first time TheSky is launched, the window is size using the default screen size. In later sessions, the window is restored to its previous size and position on the Desktop.
- **Desktop:** The computer's Desktop is displayed on startup. From there, double-click the desired icon to launch an application, or navigate the computer's applications by clicking **Menu** located in the upper left of the Desktop.

System Time Zone Options

The earth location data that is transmitted by Global Position Satellites (GPS) does not provide local time zone information, so you must choose the nearest city or region to define it. When displaying celestial objects, the observing location's time zone is required.

To configure the operating system's time zone, choose the appropriate time zone description from the list and click the **Apply Now** button.

Remote Screen Resolution Options

The resolution of The Fusion's virtual display, specified as the width and height, in pixels, can be selected from the **Remote Screen Resolution** list.

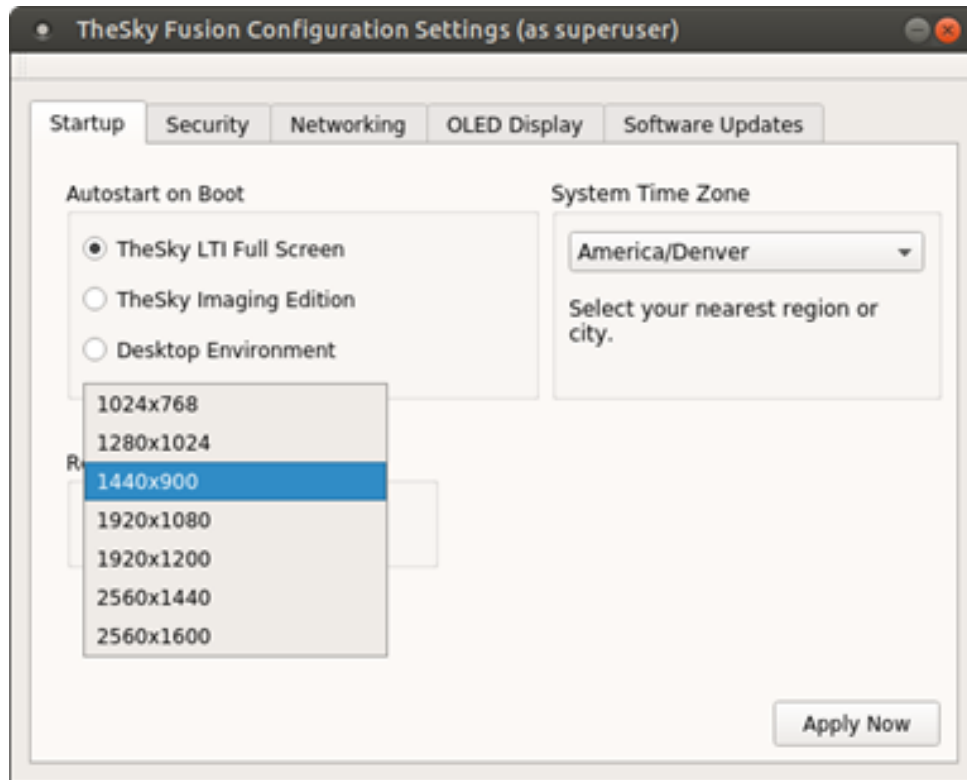


Figure 17: Setting the Remote Screen Resolution.

Apply Now Button

Click this button to permanently save the **Startup** tab options.

Security Tab

The **Security** tab is used to change the Wi-Fi password and the password to access TheSky Fusion's Desktop from a web browser.

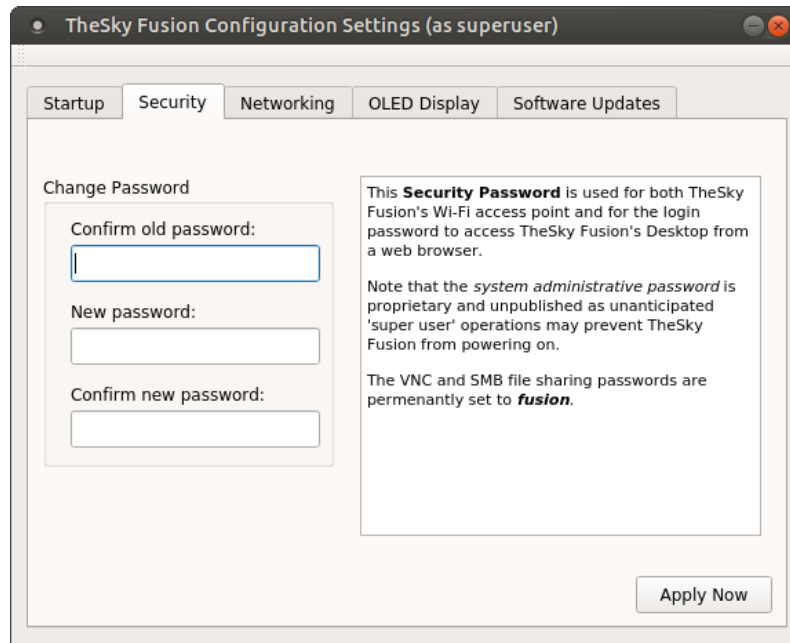


Figure 18: The **Security** tab configures TheSky Fusion's Wi-Fi hotspot and web-browser access password.

Networking Tab

The **Networking** tab lets you configure:

- The **Network Device Name**, which is how other devices see TheSky Fusion on a network.
- The **Network SSID**, which is the name of the ad hoc Wi-Fi network or “hotspot” TheSky Fusion creates.
- The frequency of the wireless connection.
 - **2.4GHz**: The lower frequency results in a longer operating range and works better through building walls.
 - **5.0GHz**: The higher frequency produces faster communication rates while limiting the network’s range of operation and is less effective passing through permanent structures.

The actual operating distance a wireless network can achieve depends on many factors, including RF noise, building materials and construction, the number of other wireless networks nearby and other factors.

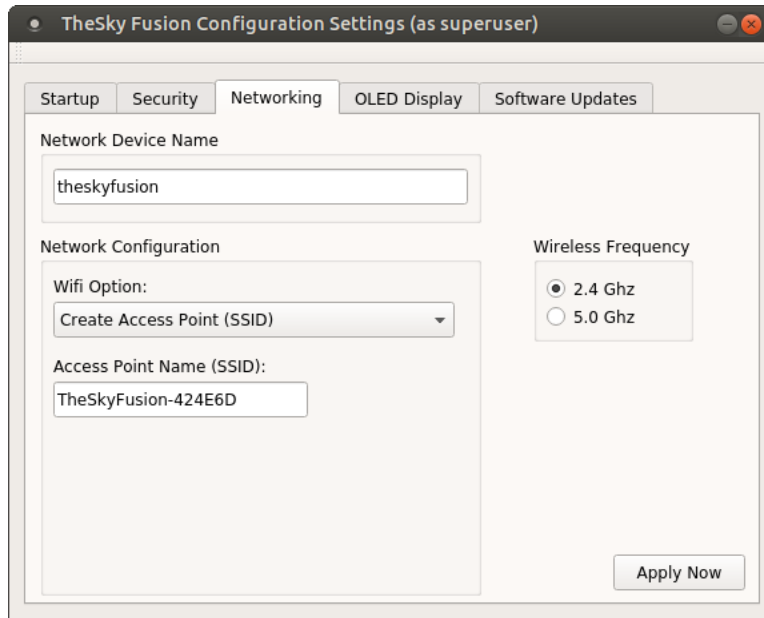


Figure 19: TheSky Fusion's Wi-Fi Access Point network settings.

TheSky Fusion can also be connected to an existing (or *infrastructure*) Wi-Fi network.

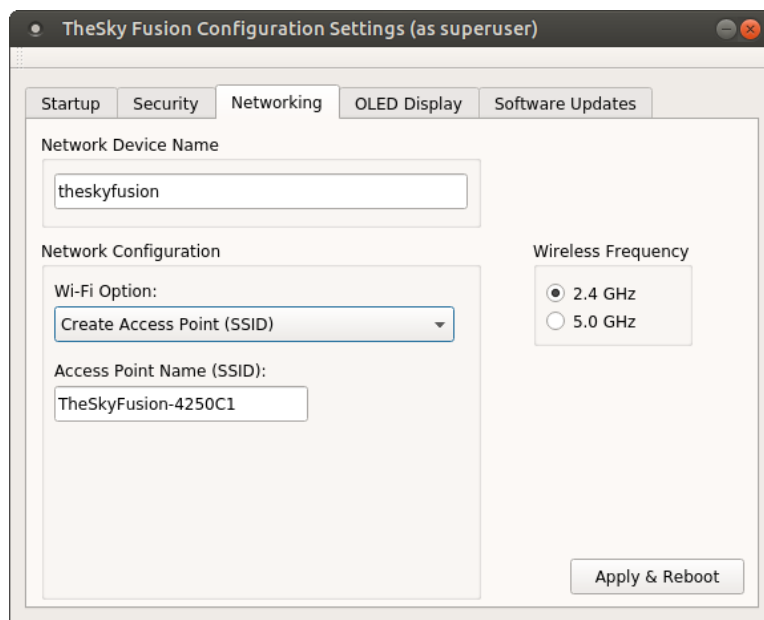


Figure 20: The infrastructure network settings.

External Display

The **OLED Display** tab lets you enter text in the **Test Text** control; clicking **Set** shows the text on TheSky Fusion's external display. The **Brightness** slider changes the display's brightness.

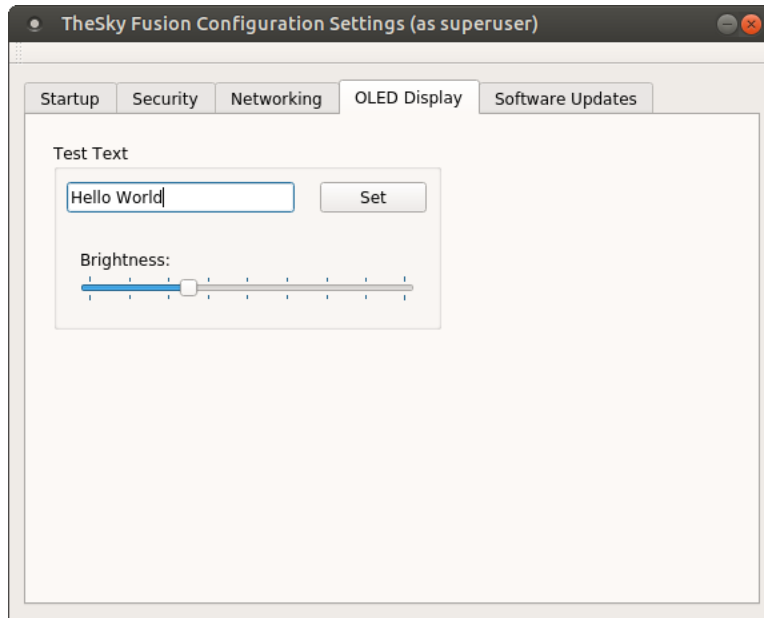


Figure 21: Show a test message to TheSky Fusion's OLED display.

Software Updates

TheSky Fusion's software resources, for example, *TheSky Imaging*, *TheSky Fusion Configuration Settings* application, equipment *drivers* and *plug ins* are periodically updated. Use the procedure described below to install the latest software.

Downloading Updates

Provided your TheSky Fusion serial number is registered, and your annual software subscription is active, TheSky Fusion software updates are available from your Software Bisque website account.

If TheSky Fusion has access to the web, download the update directly.

1. Connect to TheSky Fusion (either remotely or locally).
2. Close TheSky Imaging if necessary and click **Menu > Internet > Firefox Web Browser** from the **Desktop**.
3. Enter www.bisque.com into the browser's address bar and click **My account > Login**.
4. Enter your **Username or Email Address** and **Password** and click the **Log In** graphic.
5. Click **My account > My Download** to view your downloads (Figure 22).
6. Click **TheSky Fusion Update** graphic to download the file. Firefox saves downloads to the **Downloads** folder.

My account

Dashboard	Product	Serial Keys	Downloads remaining	Expires	Download
Just Serial Numbers	TheSky Fusion	-	∞	Never	TheSky Fusion Update (2020-08-12 615 KB)
Orders					
Subscriptions					
Downloads					
Addresses					
Account details					
Logout					

Figure 22: Click **TheSky Fusion Update** graphic to download the updater to your computer.



TheSky Fusion updates are displayed and can be downloaded when:

- You purchased TheSky Fusion from the Software Bisque Store.

–OR–

- Your TheSky Fusion serial number has been registered with Software Bisque. (See www.bisque.com/register for details.)

–AND–

- Your TheSky Fusion subscription is active.

Figure 22 shows an example of the Software Bisque website's **My Account > My Downloads** page. If you have purchased and registered multiple products (thank you!), scroll down to locate the appropriate link.

If TheSky Fusion does not have Internet access, the file must be downloaded to a separate computer first.

1. Download the update and save the update to a USB thumb drive or removable SSD.
2. Plug the drive into one of TheSky Fusion's USB ports.
3. When the USB drive is recognized, a file manager window appears showing its contents. (Alternatively, click **Menu > System Tools > Caja** to show a file manager window, then click the name of the USB drive under **Devices** on the left column of the file manager window.)

Select Update File

Click the **Select Update File** button to choose the update archive file.

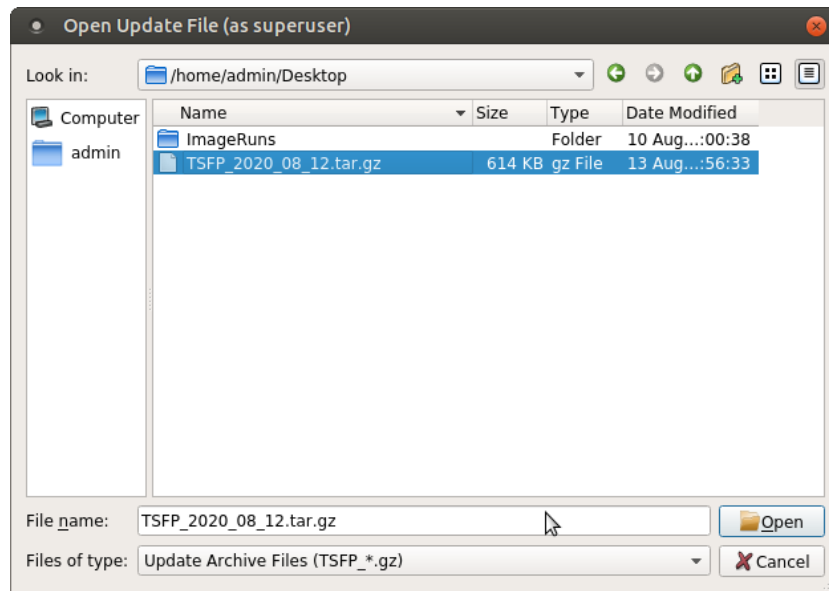


Figure 23: Choose TheSky Fusion update.

The **Software Updates** tab is used to select an archive that contains the update. The archive file name uses the following convention:

TSFP-YYYY-MM-DD.tar.gz

Where:

- *TSFP* is the abbreviation for **TheSky Fusion Patch**
- *YYYY* is the year.
- *MM* is the month.
- *DD* is the day the patch was created.
- *.tar.gz* indicates the file is a compressed archive.

When you have selected the update file (Figure 23), click **Open** to apply the update. When the update is complete, click **Yes** to restart.

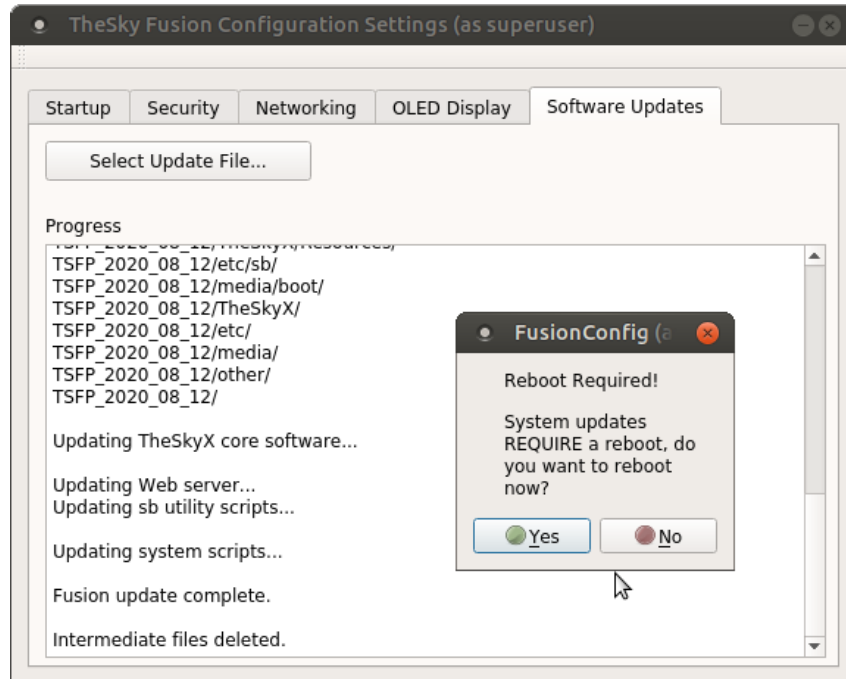


Figure 24: Updating TheSky Fusion's software.

Hardware Configuration



Please exercise great caution every time you connect your equipment to TheSky Fusion's power output ports!

Your equipment can be irreparably damaged if the power output port is configured to supply a voltage that is not compatible with your hardware.



Figure 25: TheSky Fusion DC Voltage Meter showing 12.1V.

Power Output Disclaimer: The user assumes all liability for equipment damage caused by incorrectly configured output voltages. Software Bisque strongly recommends that you always verify the voltage of every power output port using TheSky Fusion DC Voltage Tester before connecting any device.

Power Output Port Basics



Figure 26: TheSky Fusion's eight power output ports (labeled 1-8).

- TheSky Fusion includes eight power output ports on the front panel. The port's number is laser-etched below the ports on the front panel. Please refer to Figure 2 on page 9 for a diagram that shows the number assigned to each power output port.
- The factory default output voltage for all eight ports is 12V DC.
- The output voltage on power output ports 1, 2, and 8 is configurable as described below.

Configuring the Power Output Voltage

Use the supplied 5/32-in. T-handle hex wrench to disassembly the external housing and give access the switches that allow the output voltage for power output ports 1, 2, or 8 can be changed.

1. Loosen the two bolts on the front of TheSky Fusion about four turns.
2. Remove the two bolts on the top of TheSky Fusion. Flip the top of Fusion over to access the inside.
3. On the large red printed circuit board (PCB) there are three small switches. Each one is labeled for which position sets the voltage to which position. Then repeat the steps in reverse to reassemble TheSky Fusion.

Power Control

TheSky Fusion has eight *external power ports* that use Anderson Powerpole connectors. The first time TheSky Fusion is turned on, all these ports are turned off. Each power port can be turned on or off separately from the **Power Control** window in TheSky Imaging.



Figure 27: Use TheSky's Power Control window to turn devices on or off.

Like other equipment, you must first establish a connection to TheSky Fusion's power ports before TheSky can control and configure them.

Configuring the Power Ports

1. Turn on TheSky Fusion and establish a local or remote connection. By default, TheSky Imaging is launched automatically when TheSky Fusion is powered on.

If TheSky Fusion Configuration Settings app's **Startup** tab > **Autostart on Boot** option has been set to **TheSky LTI Full Screen** (Figure 16) close TheSky LTI and double-click TheSky Imaging icon on the Desktop to launch it. If the **Desktop** option is selected, double-click TheSky Imaging icon on the Desktop.

2. From TheSky Imaging, click **Telescope > Telescope Setup** to show the Imaging System Setup window.

3. Under **Imaging System** on the left side of the window, double-click **Power Control** to show the **Choose Power Control** window. If not already selected, expand **Software Bisque**, then highlight **TheSky Fusion Power Control** and click **OK**.
4. On the **Imaging System Setup** window, click **Power Control Setup > Connect**. The **Status** text should show **Ready**.
5. On the **Imaging System Setup** window, click **Power Control Setup > Settings** (Figure 28).

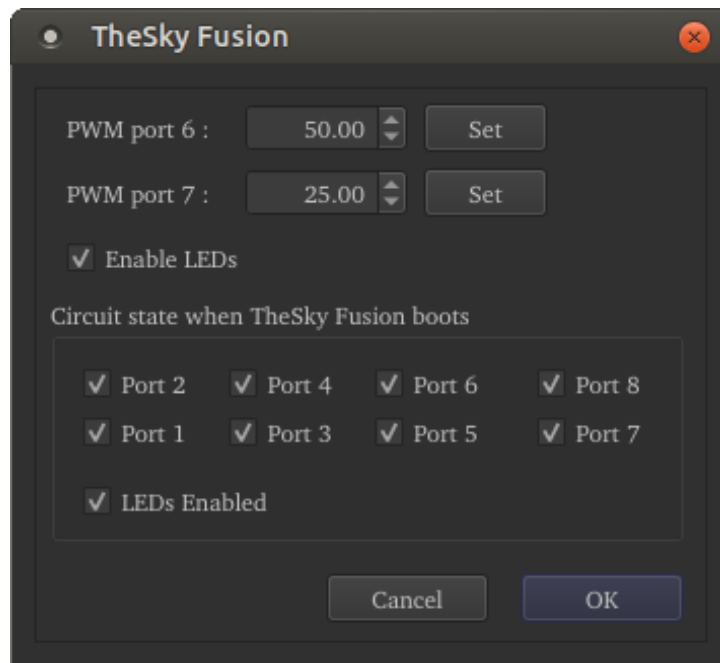


Figure 28: Configure the power out ports from the Settings window.

6. If you plan to use one or both pulse-width modulated ports to power a dew heater, enter a value the pulse-width modulation frequency for ports 6 and 7 (minimum of 0 to 100), then click **Set**. Turn on the **Enable LEDs** checkbox to illuminate the LEDs next to the ports on the front panel when they are turned on. The LEDs will not illuminate when the power port is turned off.
7. Under **Circuit State When TheSky Fusion Boots**, turn the checkbox on or off as desired. The state of these ports is saved and restored each time TheSky Fusion is turned on. Turn on the **Enable LEDs** checkbox to illuminate the LEDs next to the ports on the front panel.



Enable LEDs vs. LEDs Enabled Checkboxes

Turning the **Enable LEDs** checkbox off disables all the LEDs on the front panel, including the GPS LED. No LED on the front panel emits light under any circumstance. Turning the **Enable LEDs** checkbox turns on the GPS LED (it flashes steadily off and on). Provided the power to a given power port is turned on, the LED next to the power also emits steady light.

When the **LEDs Enabled** checkbox is turned off and TheSky Fusion is restarted, no LEDs on the front panel emit light. When this checkbox is turned on and TheSky Fusion is restarted, the GPS LED flashes, and the *powered* power port LEDs emit light.

External Display Status Messages

TheSky Fusion's external OLED display provides startup, shutdown, status, and error messages from TheSky Imaging.

Most messages are self-explanatory and can be helpful to monitor the progress of automated tasks such as automated pointing runs or while taking photos in series. Error messages can help track down issues like equipment configuration problems or connection failures.

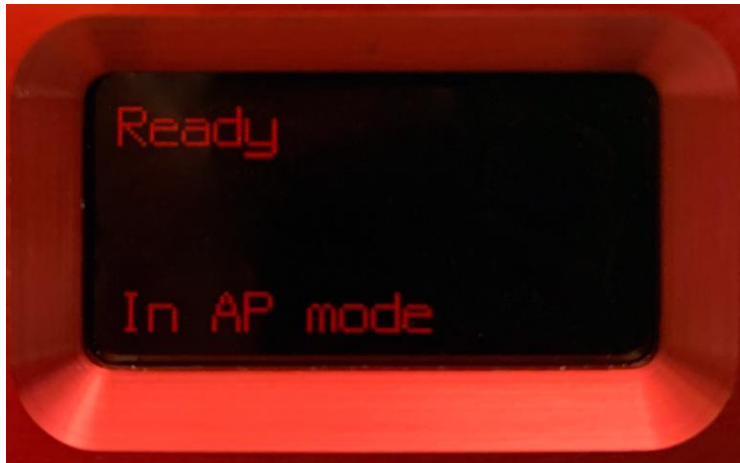


Figure 29: The display's default startup, steady-state message.

In AP mode Display Text

When TheSky Fusion is powered up, initialized, and TheSky has been launched, the external display shows the text **Ready** and **In AP mode** once the Wi-Fi hotspot *access point* is available.

Display Brightness

The brightness of the display can be configured from the **OLED Display** tab in TheSky Fusion Settings application (page 29).

Using TheSky Imaging

Please refer to TheSky Professional User Guide for details how to use, setup, connect to, and control your imaging equipment from TheSky Imaging Edition. From TheSky, click **Help > TheSky User Guide** to view this document.

The following describes TheSky Imaging features that are *specific to TheSky Fusion*.

Setting TheSky's Location

TheSky Fusion's built-in GPS can be used to accurately determine the longitude and latitude of your observing location. TheSky Imaging uses this information to show the location of objects and the location of the local horizon on the Sky Chart.

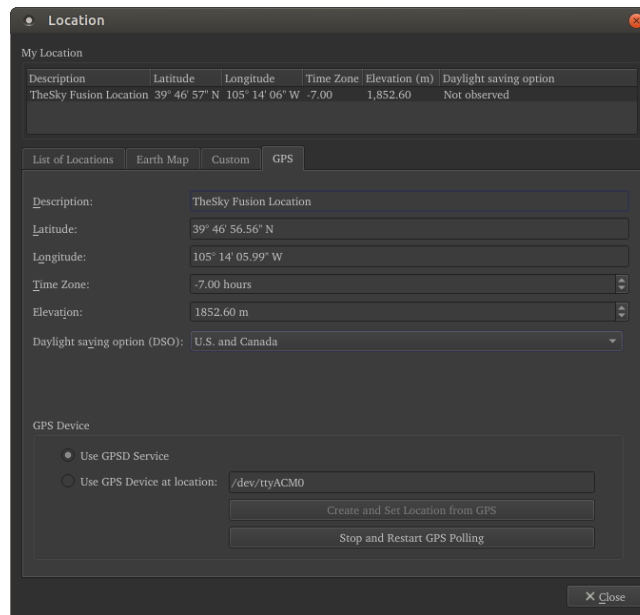


Figure 30: TheSky's **Input > Location > GPS** tab.

From TheSky Imaging, click **Input > Location > GPS** tab. Once a GPS link is established, TheSky's **Latitude**, **Longitude**, and **Elevation** values can be set by clicking the **Create and Set Location From GPS** button. GPS data does not include the following required location parameters, so they must be entered manually:

- A location **Description**
- The current **Time Zone** (positive east, negative west)
- The **Daylight-Saving Option**

Under **GPS Device**, the default option **Use GPSD Service** retrieves the GPS location data. To use a different GPS device, click the **Use GPS Device at Location** option and enter its path and name.

Stop and Restart GPS Polling

Click this button to reset GPS device polling. Note that establishing a GPS link takes about 15 minutes when TheSky Fusion has been moved to a new location.

The flashing red LED to the right of the power button indicates the GPS is operational. See component number 9 in Figure 2 for more information.



Figure 31: Location of TheSky Fusion's GPS LED.

Mount Control Notes

- Mounts that use serial communications with DB-9 telescope cable connectors can be plugged directly into TheSky Fusion's RS232 port. When configuring TheSky Imaging to communicate with this mount, click **Telescope > Telescope Setup > Mount > Mount Setup > Settings** and select the **Serial Device** named **/dev/ttyS1**.
- Mounts that connect via USB (including Paramount mounts with the MKS 5000 control system) plug directly into one of TheSky Fusion's USB ports. Under **Telescope > Telescope Setup > Mount > Mount Setup > Settings**, select the **Serial Device** named **<Name of USB Adaptor>**, where **<Name of USB Adaptor>** is the name of the USB adapter driver on Linux, which varies by manufacturer. For example, the Keyspan 19HS USB adapter is listed as **/dev/cu.KeySerial1**.

The Gaia Star Catalog

The entire Gaia Data Release 2 (DR2) consumes over 1.2 TB of disc space and can be downloaded from the [Gaia archive page](#). When the complete catalog is present, for example, on an external USB 1.5 TB or larger SSD or disk drive, *TheSky Imaging's* Sky Chart can display every star from the Gaia catalog along with accompanying "metadata".

TheSky Fusion includes two subsets of the Gaia star catalog that should suit the needs of most.

- The small Gaia subset contains about 100 million stars equally distributed across the celestial sphere and is ideal for determining the astrometric solution for photos as small as about 3 arc minutes across. By default, TheSky Imaging displays stars from this dataset.
- The large Gaia subset contains the RA, Dec, magnitude, spectral class, and proper motion for 1.7 billion stars. For TheSky Fusion, this 94 GB dataset is located on the **Mass Storage** volume.

The following sections describe how to configure *TheSky Imaging* to display stars from the Gaia catalog.

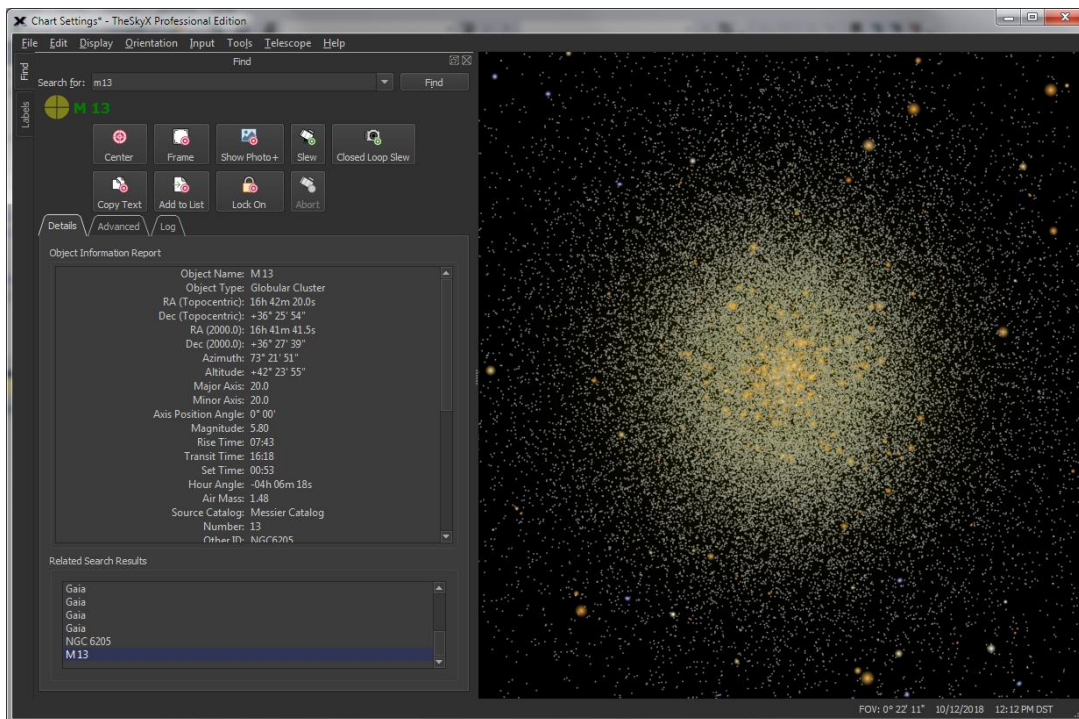


Figure 32: Sky Chart showing the Gaia stars (only) in the Hercules Globular Cluster (M13).

Displaying Stars from the Large Gaia Subset

Follow the steps below to configure TheSky Imaging so that stars from the larger Gaia subset are displayed.

1. From TheSky Imaging, click **Input > Database Manager**.
2. Under **Databases**, expand **Core Databases > Stellar Databases** and highlight **Gaia**.
3. Click the **Choose Folder** button in the lower left corner of the **Database Manager** window.
4. Navigate to and select the **/media/admin/Mass Storage/Gaia** folder and click **Choose**.
5. Click **Close**.

Table 1: Gaia Catalog Subsets

Catalog	Number of Stars	Disc Space Occupied
Larger Gaia Subset	1.7 billion stars	93.6 GB
Smaller Gaia Subset	100 million stars	4.62 GB

Gaia Stars on the Sky Chart

While the Gaia catalog contains a few brighter stars (as bright as magnitude 5), it does not contain most bright stars. As such, sky charts begin to show Gaia stars at fields of view near 7 degrees and smaller. Stars displayed at wider fields of view are from the Hipparcos-Tycho and other star catalogs.

Gaia vs. UCAC and NOMAD Catalogs

For the most part, the Gaia catalog supersedes the UCAC3, UCAC4 and NOMAD star catalogs. Placeholders for these older star catalogs appear for backward compatibility.

Appendix A: Power Out Port Configuration

The maximum output power supplied to three of TheSky Fusion's eight power out ports is configurable. See "Hardware Overview" on page 9 for the specifications of each power out port.

Open the external housing as described below to access the power output configuration switches.

Opening TheSky Fusion Housing

1. **Turn off power and disconnect all cables.** Shutdown TheSky Fusion and unplug every external cable from the unit.
2. **Loosen the front panel screws.** Place the unit on a flat surface with the front facing toward you. Use the 5/32-in. hex wrench to rotate the two socket head cap screws on the front panel counterclockwise until they can be removed, then rotate each one turn clockwise so that the threads are engaged. When both screws are loose, but not completely removed, push the front panel against the screws.
3. **Remove the top panel screws.** Use the 5/32-in. hex wrench to rotate the two socket head cap screws on the top of the housing counterclockwise until they can be removed. Store them in a safe place for now.
4. **Separate the top of the housing from the bottom.** With the front panel pushed outward, against the loose front panel screws, gently lift the top panel while tilting it forward slightly. The tilting motion allows an internal cable to clear a recess in the front panel. Note that the top and bottom are still connected by a ribbon cable on the left side of the housing, so resist trying to pull them completely apart.
5. **Lay the top next to the bottom.** Gently lay the top next to the bottom as shown in Figure 33.



Figure 33: Gently rotate the top counterclockwise and set it next to the bottom.

Once the two halves are separated, the power out port configuration switches are located on the PCB attached to the bottom of the housing (Figure 34). Move the switch or switches to the desired position and you are ready to reassemble the housing.

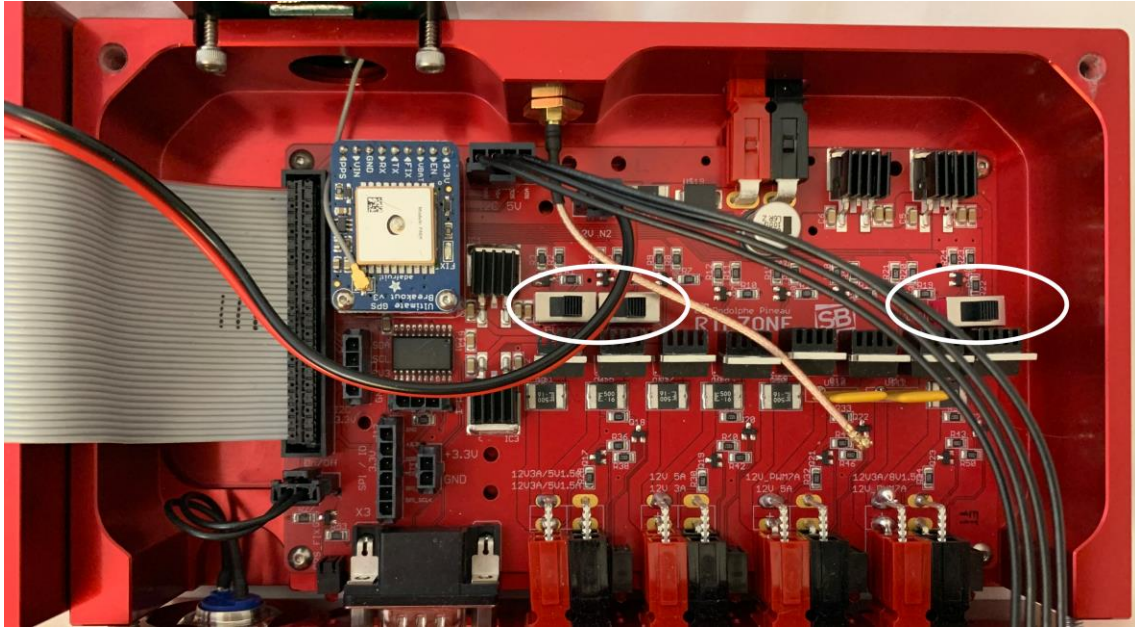


Figure 34: Location of the power out configuration switches.

Figure 35 show the switch associated with each configurable port.

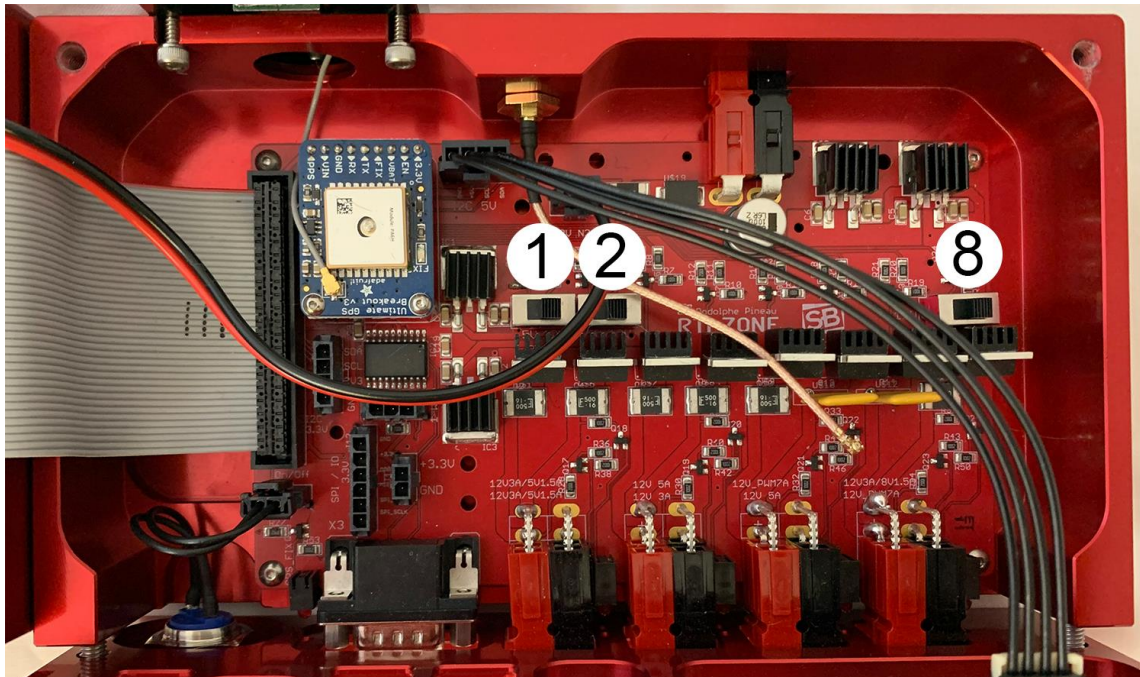








Figure 35: The maximum power supplied by ports 1, 2 and 8 is configurable.

Power Output Port Number	Switch Position	Power Specification
1		5V \equiv 1.5A 7.5W max.
		12V \equiv 3A 36W max.
2		5V \equiv 1.5A 7.5W max.
		12V \equiv 3A 36W max.
8		12V \equiv 3A 36W max.
		8V \equiv 3A 24W max.

Once the switches have been moved in the desired positions, reassemble the external housing, power up TheSky Fusion, and verify the output voltage on each port with TheSky Fusion DC Voltage Tester.

Appendix B: User Guide Revision History

Revision Number	Changes
2.1	<ul style="list-style-type: none"> Added TheSky Fusion serial number to the rear view graphic.
2.0	<ul style="list-style-type: none"> Updated copyright information. Minor documentation changes.
1.9	<ul style="list-style-type: none"> Removed incorrect password reference.
1.8	<ul style="list-style-type: none"> Added serial number registration details.
1.7	<ul style="list-style-type: none"> Removed unnecessary screen captures. Grammar and spelling check review.
1.6	<ul style="list-style-type: none"> Added note about TheSky Fusion shutdown procedure. Updated graphics and miscellaneous documentation.
1.5	<ul style="list-style-type: none"> Corrected the output voltage of each switch position on power out port 8.
1.4	<ul style="list-style-type: none"> Expanded Wi-Fi access instructions. Updated photos. Added GPS-related details. Expanded Power Control window documentation.
1.3	<ul style="list-style-type: none"> Expanded the description of TheSky Fusion software update process.
1.2	<ul style="list-style-type: none"> Added missing photos. Minor formatting revisions. Added System Time Zone documentation.
1.1	<ul style="list-style-type: none"> Revised and expanded Appendix A instructions. Added Power Control documentation.
1.0	Original document