RAYN Setup Guide

RAYN Vision System Camera

Overview

The RAYN Vision System (RVS) Camera is a compact research tool for observing and recording across multiple light wavebands, and includes a variety of connectivity options for remote and automated image capture, processing, and analysis.

Specifications

- Factory presets for 30, 40, 60, 80, 100, and 150 mm focus distances.

Ambient Environment

- IP54-rated for indoor use only.
- 5°C–35°C (41°F–95°F) operating temperatures.
- 10%–90% non-condensing humidity (non-corrosive).

Electrical

The RVS-C ships with an approved AC to DC power supply with a selection of regional adapters.

CAUTION: ***This product is intended for use with a UL Listed power source (LPS) marked "Class 2", or LPS rated 24 V DC, maximum 1.5 A. Use only the provided power supply.***

Dimensions

Main Body Diameter		Main Body Height		Mounting Hole Spacing		Mounting Flange Extension	
100 mm	3.94 in	55 mm	2.17 in	120 mm	4.72 in	142 mm	1.65 in

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rayngrowingsystems.com

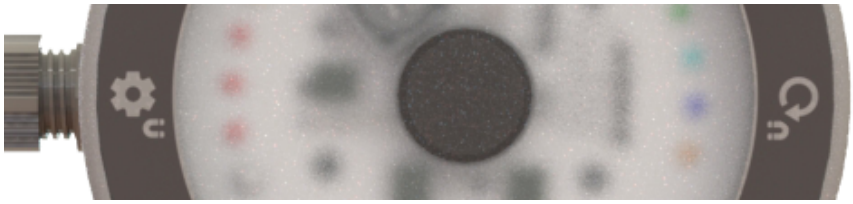
Connections and Storage

RVS-C communication and firmware updates use Wi-Fi. Internal storage is provided by the included 32 GB microSD card.

The RVS-C includes a 0–24 V input and a contact closure output, which allow the camera to trigger or be triggered by external devices. See *Setup > Input / Output*.

Magnetic Contacts

Two magnetic contacts are also available, one on either side of the camera.



- **Configuration** (left) - reboots the camera in *Access Point* mode.
- **Reset** (right) - resets the camera to factory settings. See *Setup > Factory*.

LEDs illuminate white when a magnet is held on either side of the camera. Hold the magnet for three seconds or more to confirm with green LEDs and activate the respective function described above.

Wireless

- 2412–2472 MHz frequency range.
- 5 MHz channel spacing.
- 19.9 dBm EIRP transmit power.
- DPSS, OFDM modulation.
- Model: ESP32-S3-WROOM-1
- FCC TX ID: 2AC7Z-ESPS3WROOM1
- Canada IC: 21098-ESPS3WROOMU

RAYN Setup Guide

RVS Camera

Camera Setup

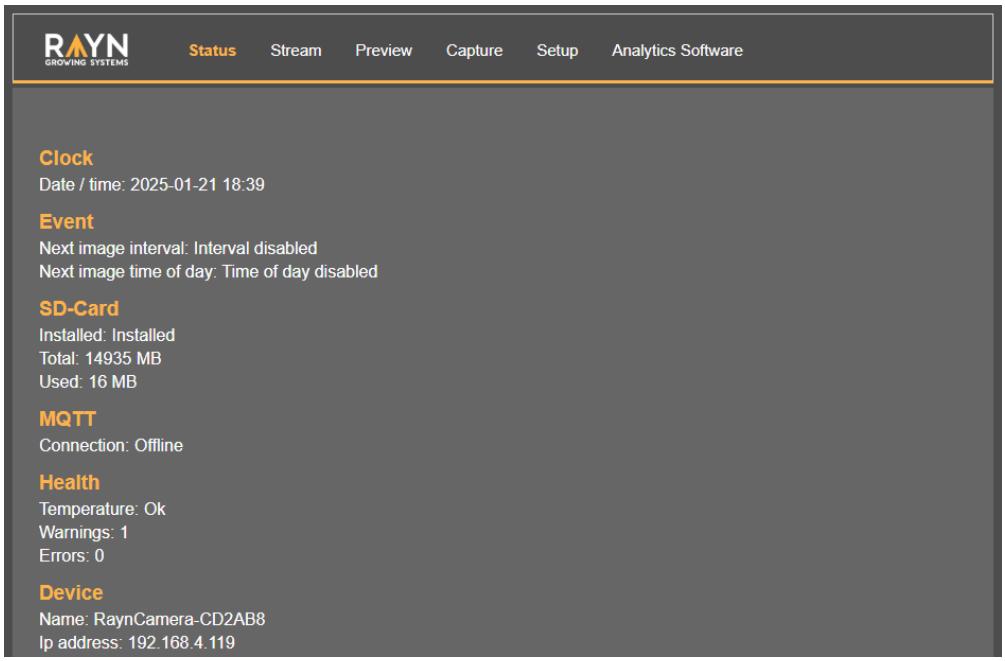
The RVS Camera *Web Interface* must be accessed for initial setup.

1. Connect the camera to mains power using the included 24 V power supply. LEDs illuminate as the camera powers up.
2. On initial power up, the camera will activate in *Access Point* mode, appearing as an available wireless network. Using a computer running Windows® 10 or later, connect to the wireless network with the following credentials:
   - **Name** - RaynCamera-######, where the six characters are the camera's unique hexadecimal ID.
     - For example, **RaynCamera-CD2AB8**. Each camera's ID is unique.
   - **Password** - Password
3. Open a web browser and enter the default IP address, **10.1.2.1**, in the URL field to access the web interface and begin initial *Setup*. You will be required to change the **Access Point** password.
4. To put the camera in **Wi-Fi** mode, enter the credentials for an existing network on the *Setup > Wi-Fi* tab, then reboot the camera via *Setup > Factory*, or by cycling power.
5. Once the camera is in *Wi-Fi Client Station* mode connected to an existing network, you may access the camera's web interface by navigating to either of the following addresses:
   - Your camera's name, including the hexadecimal ID. This option is not compatible with HTTPS, and may not be compatible with all routers or web browsers.
     - For example, **http://RaynCamera-CD2AB8/**. Each camera's ID is unique.
   - Your camera's IP address. This option is not compatible with HTTPS.
     - For example, **http://192.168.4.119/**. Each camera's IP address is unique.

Additional cameras may be connected by repeating the steps above.

Web Interface

The RVS Camera web interface automatically opens to the **Status** page of current camera information.



Additional sections of the web interface can be accessed via the top menu bar:

- *Stream* - stream images to assist with camera setup and positioning.
- *Preview* - manually take an image under a specific spectrum.
- *Capture* - configure a variety of automatic capture options for the connected camera.
- *Setup* - alter configurations, update firmware, and back up and restore settings.
- *RAYN Vision System Analytics* - information about the RAYN Vision System Analytics image processing and analysis software.

All settings changes are committed using **Save** buttons at the bottom left of the screen, which illuminate yellow when there are unsaved changes. If you navigate to a different area of the web interface before saving, you will be prompted to keep your changes (**OK**) or discard them (**Cancel**) before being redirected.

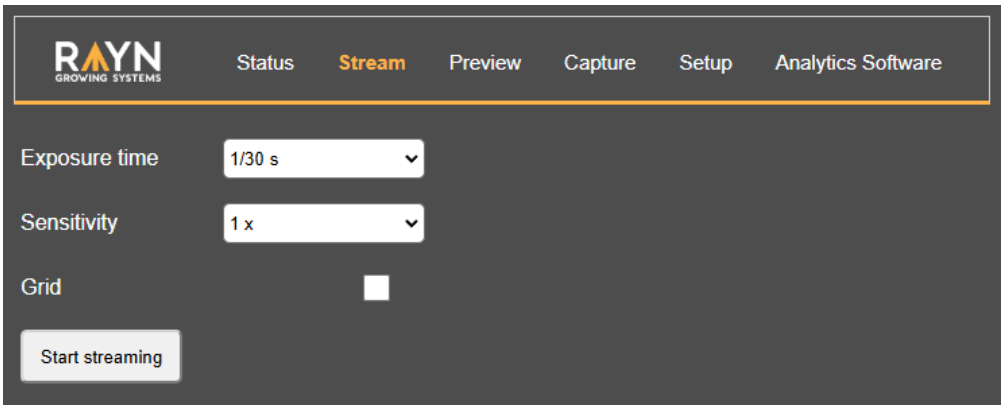
Status

The following information about the connected camera is available:

- **Clock** - the camera's current date and time.
- **Event** - upcoming events scheduled on the camera.
- **SD-Card** - the camera's installed SD card and storage status.
- **MQTT** - connection status with the specified *Setup > MQTT* server.
- **Health** - the camera's current temperature and related warnings or errors.
- **Device** - key camera information, including the name, IP address, firmware version, MAC address, RSSI, and up time.
- **Log** - a record of each major camera event, with the most recent at the top.

Stream

This section allows you to stream images to assist with camera setup and positioning.



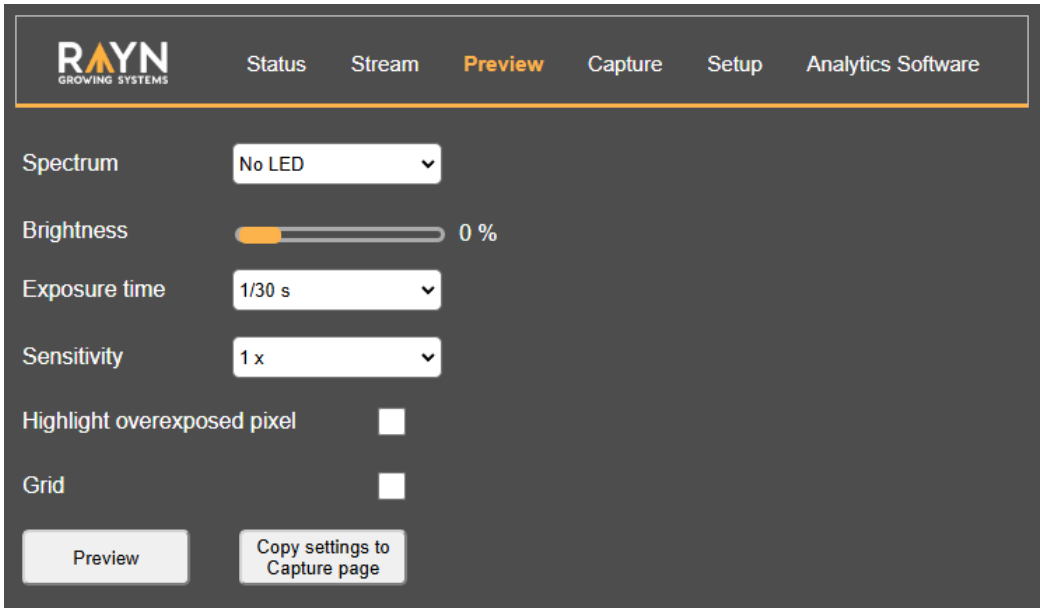
When streaming, one image per second will be transmitted from the camera. The following additional image options are available:

- **Exposure time** - choose an exposure time from the drop-down list.
- **Sensitivity** - choose a sensitivity between 1x and 8x. 1x is sufficient for most situations; only raise sensitivity when the image is too dark.
- **Grid** - when checked, a grid will be superimposed over the images.

Use the **Start streaming** button to begin streaming images using the settings above.

Preview

This section allows you to manually take an image of a specific spectrum.



Select a light **Spectrum** to use for the image capture from the drop-down menu.

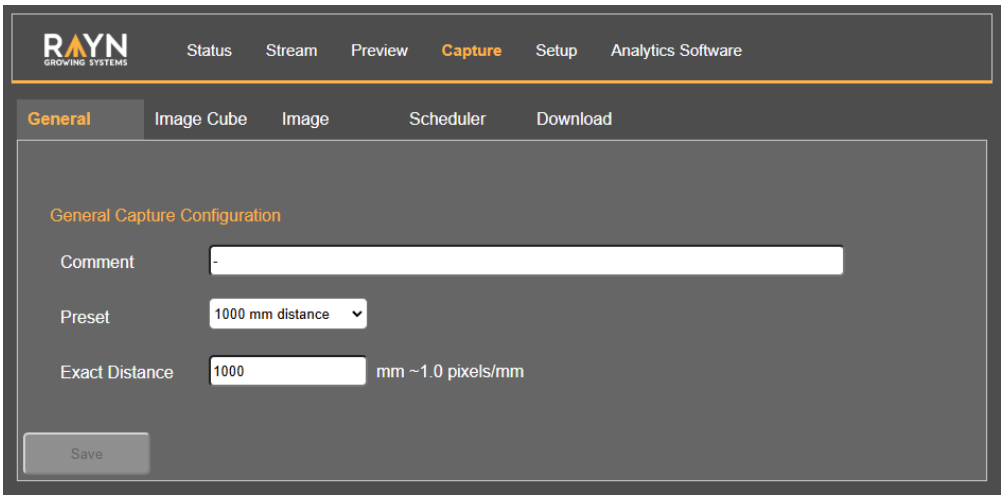
The following additional image options are available:

- **Brightness** - set the LED brightness between 0% and 100%.
- **Exposure time** - choose an exposure time from the drop-down list.
- **Sensitivity** - choose a sensitivity between 1x and 8x. 1x is sufficient for most situations; only raise sensitivity when the image is too dark.
- **Highlight overexposed pixel** - when checked, overexposed pixels will be outlined.
- **Grid** - when checked, a grid will be superimposed over the image.

Use the **Preview** button to take an image using the settings above. The **Copy settings to Capture page** button copies the settings for the selected spectrum to the *Capture* page for use in *User Presets*.

Capture

This section allows you to configure a variety of image capture options for the connected RVS Camera.



Capture opens to the **General** tab of settings. The following additional tabs are available:

- *Capture > Image Cube* - create an image cube of multiple spectra in ENVI format.
- *Capture > Image* - create a human-viewable color image.
- *Capture > Scheduler* - schedule recurring image capture for specific dates and times.
- *Capture > Download* - save captured image files from specific date and time ranges.

ENVI is a standardized, open format for storing multispectral image data, consisting of two files: a buffer (.bin) containing the binary image raster, and an ASCII header (.hdr) describing how to interpret the buffer. This data is collectively referred to as an image cube, which cannot be viewed by humans like a traditional image. Software is generally required to process and analyze the captured data; for more information, see *RAYN Vision System Analytics*.

CAUTION: ***Images should be taken by a single RVS Camera at a time with no other light sources present in the space. Additional light sources may alter recorded data and make captures misleading or unusable.***

Multiple RVS Cameras synced to the same time via the *Capture > Scheduler* tab may still capture images milliseconds apart, introducing additional light sources that could alter the recorded data. For best results, offset multiple RVS Cameras capturing in the same space by a minute or more.

To account for image capture and processing times, a single RVS Camera should not be set to capture more frequently than every two minutes.

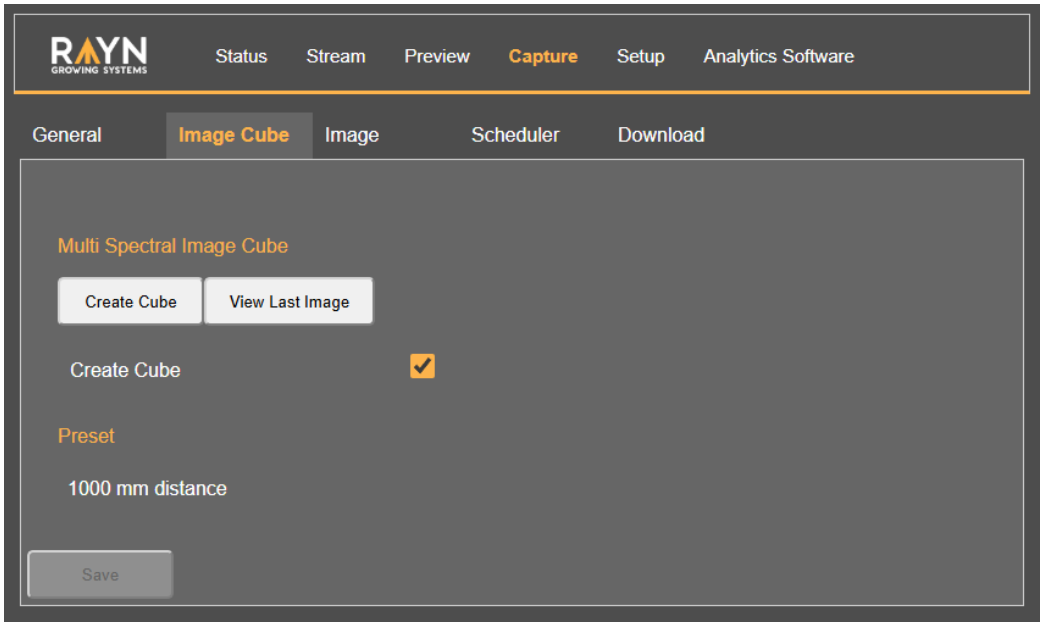
Capture > General

This tab provides general configuration options for captures via the following options:

- **Comment** - add custom text to the metadata of captured images.
- **Preset** - choose from a list of preset distances. These presets contain brightness and exposure parameters for available spectra. Three *User Presets* are also available.
- **Exact Distance** - stores the distance in the metadata of captured images. This value should match the distance in millimeters (mm) measured between the RVS Camera and the capture subject.

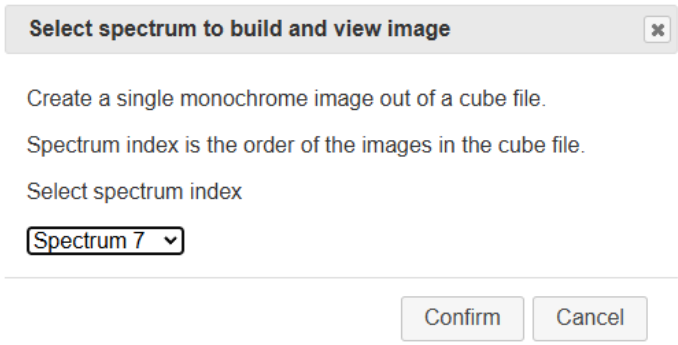
Capture > Image Cube

This *Capture* tab allows you to create an image cube of multiple spectra in ENVI format.



The following options are available:

- **Create Cube** - generates and downloads an image cube from the camera.
- **View Last Image** - displays an image from the most-recently generated image cube, whether generated manually or via *Capture > Scheduler*. Specify a spectrum from the dropdown menu in the popup.

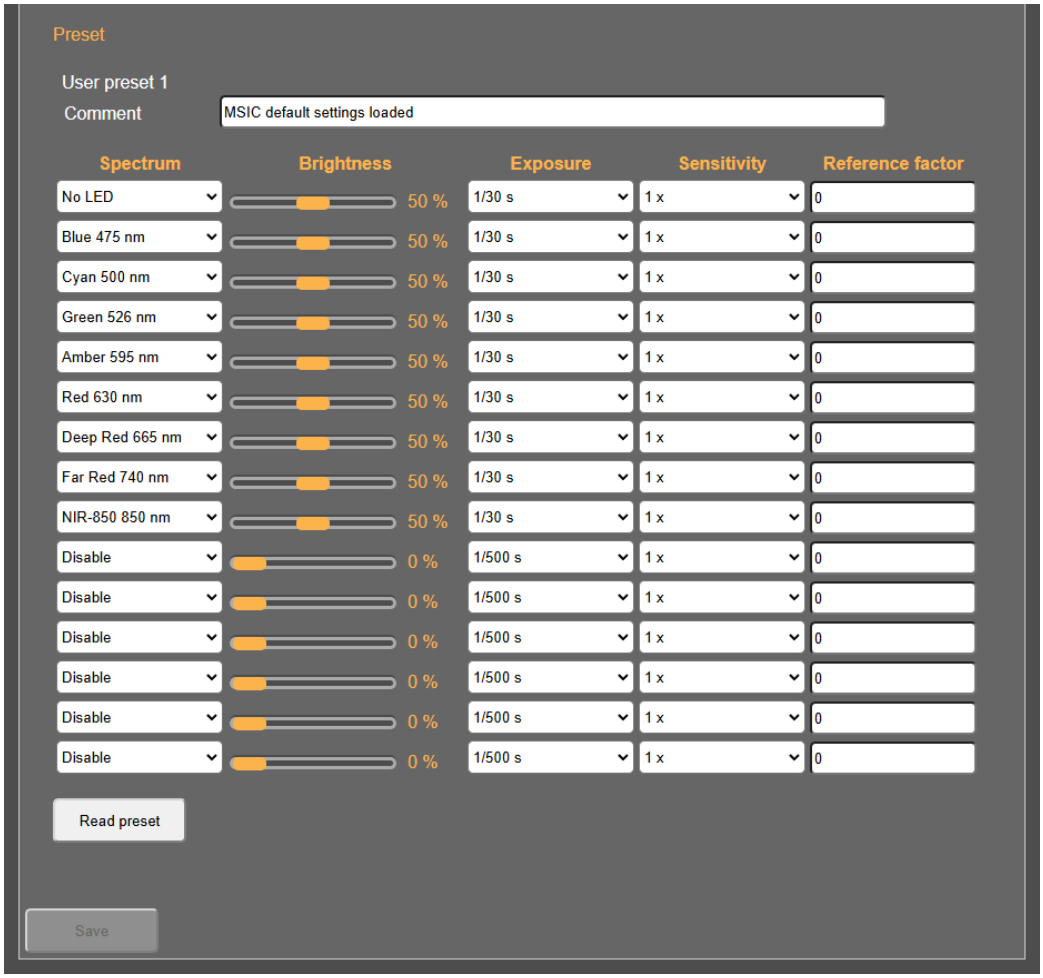


- **Create Cube** - when checked, image cubes will be created at the intervals configured via the **Scheduler**.

The preset selected on the **General** tab is also displayed.

User Presets

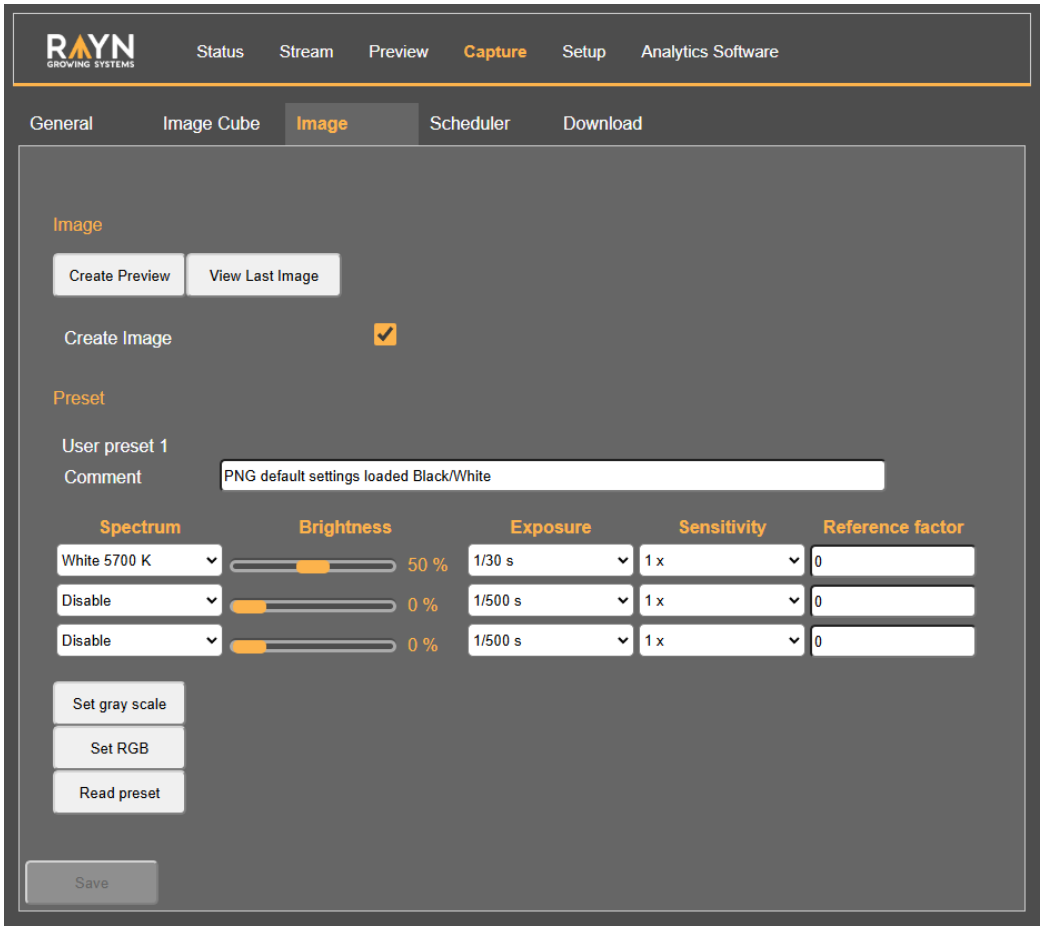
When a user preset is selected on the **General** tab, additional capture settings for each individual spectra become available on the **Image Cube** tab.



Use the sliders, drop-down menus, and fields to adjust settings for each spectra as desired. The **Read preset** button allows you to copy in the settings from a default preset. Settings can also be copied into a user preset from the *Preview* page via the **Copy settings to Capture page** button.

Capture > Image

This *Capture* tab allows you to create a human-viewable color image in PNG format.



The following options are available:

- **Create Preview** - creates a three-layer spectrum color image and displays it in the browser.
- **View Last Image** - displays the most-recently generated image, whether generated manually or via *Capture > Scheduler*.
- **Create Image** - when checked, image s will be created at the intervals configured via the **Scheduler**.

This image is typically taken using the red, green, and blue (RGB) spectra, but it is also possible to generate "false color" images using different spectra which are then rendered in the output as red, green, and blue.

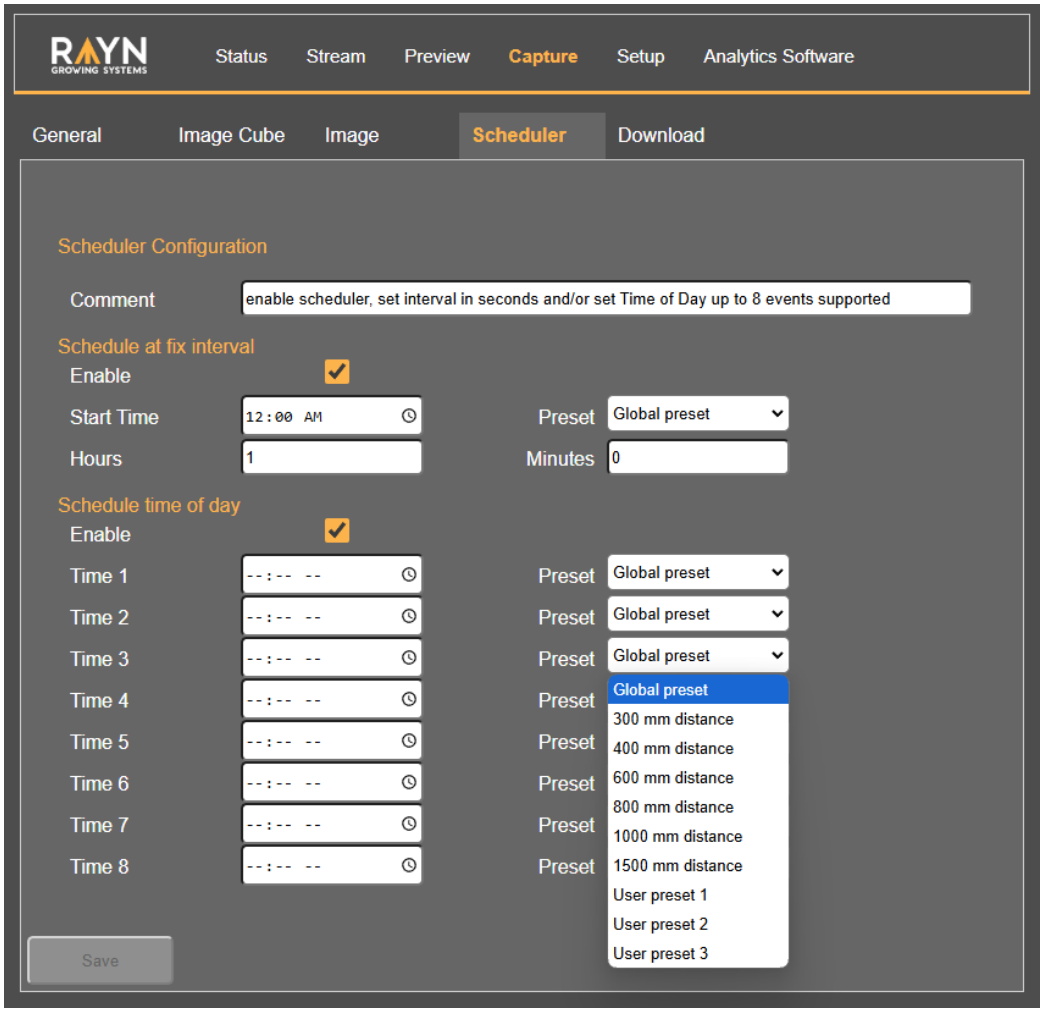
User Presets

When a user preset is selected on the **General** tab, additional capture settings for each individual spectra become available on the **Image** tab.

Use the sliders, drop-down menus, and fields to adjust settings for each spectra as desired. The **Set gray scale** and **Set RGB** buttons select preset combinations of spectra and brightness for those color spaces. The **Read preset** button allows you to copy in the settings from a default preset.

Capture > Scheduler

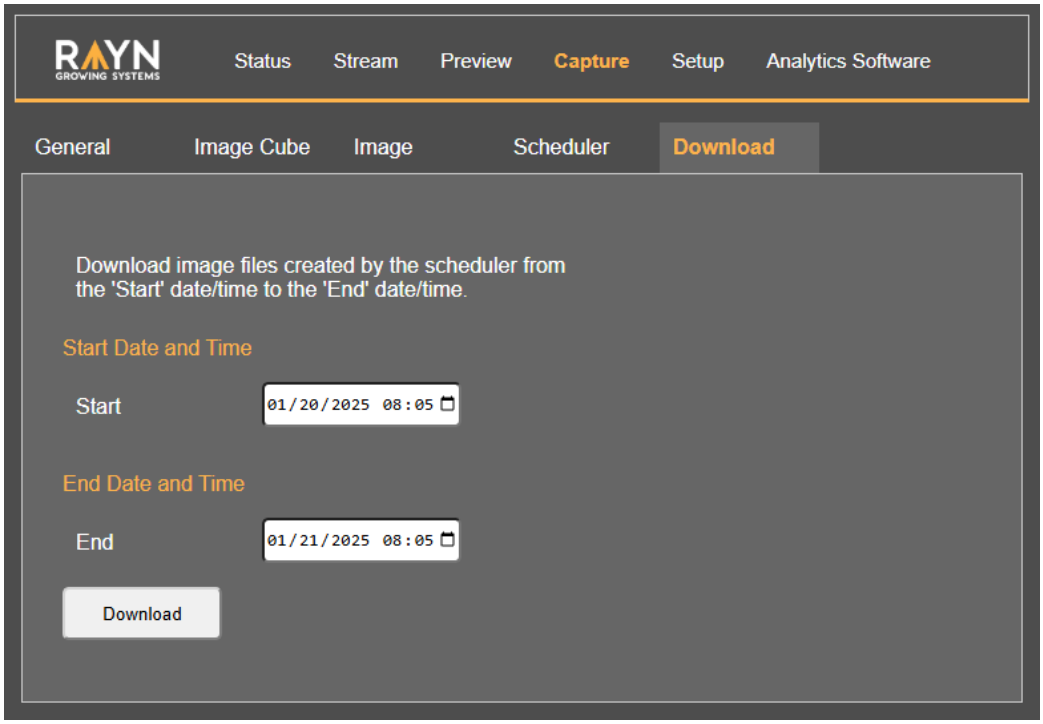
This *Capture* tab allows you to schedule recurring image captures for specific dates and times.



You can schedule image captures for either a fixed interval of hours and minutes, or at up to eight specific times of day. You can also select a preset to use for the captures.

Capture > Download

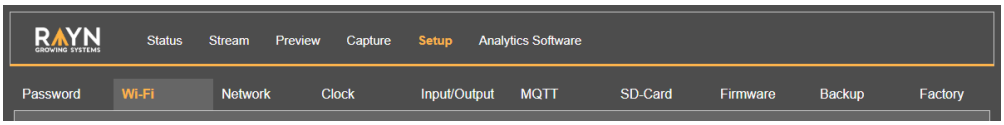
This *Capture* tab allows you to download images captured by the *Capture > Scheduler*.



You can specify a date and time range from which to download captured image files.

Setup

This section of the web interface allows you to alter the RVS Camera's local and network configuration, update firmware, and back up and restore settings.

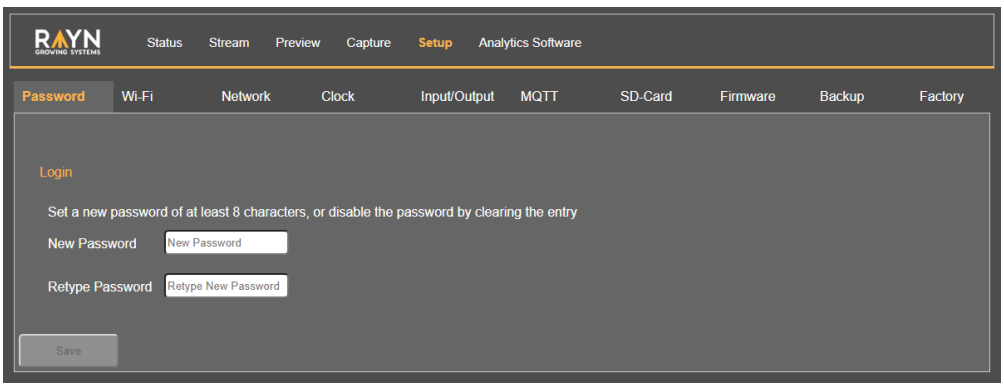


Setup opens to the *Setup > Wi-Fi* tab, where configuration typically begins. The following additional setup tabs are available:

- *Setup > Password* - set a password for **Setup** access.
- *Setup > Network* - FTP configuration settings.
- *Setup > Clock* - edit date and time settings.
- *Setup > Input / Output* - automate digital image input and output.
- *Setup > MQTT* - set up MQTT, including broker, publish, and subscription settings.
- *Setup > SD-Card* - configure automatic file deletion.
- *Setup > Firmware* - see or update the currently installed firmware and licenses.
- *Setup > Backup* - save or restore settings and download logs.
- *Setup > Factory* - alter calibration settings, reboot your camera, or reset it to factory defaults.

Setup > Password

This tab allows you to set a password required in order to access *Setup*.



The following options are available:

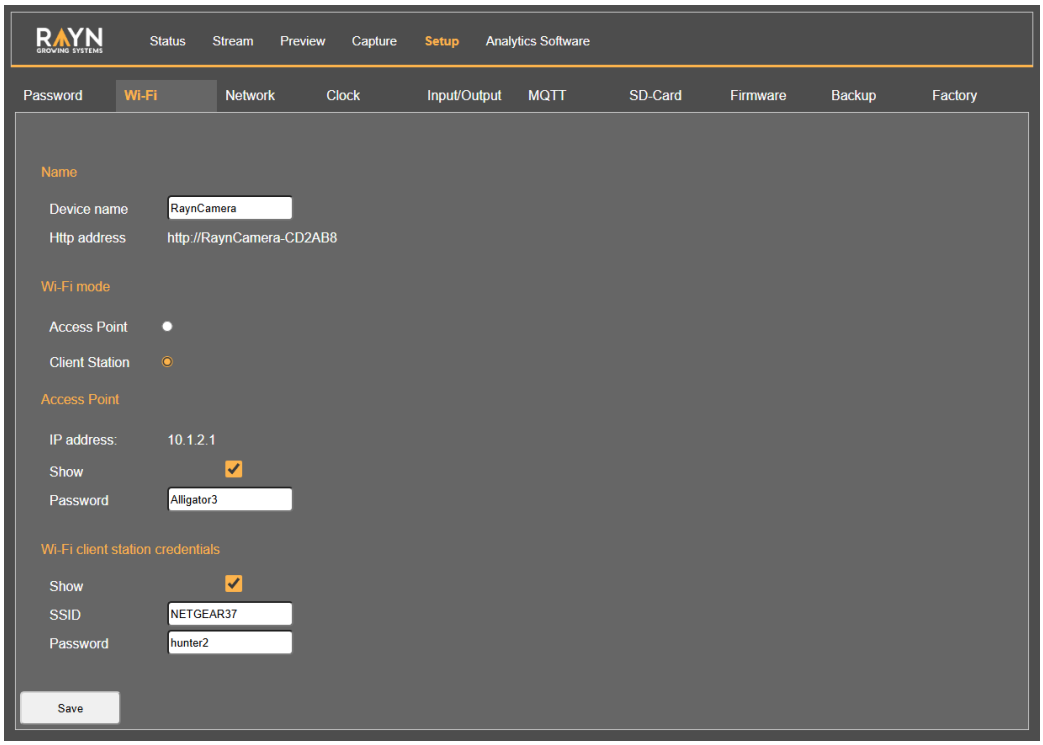
- **New Password** - enter a password of at least eight characters to be used for **Setup** access.
- **Retype Password** - re-enter your chosen password to confirm.

Once a password is set, you must enter it when selecting **Setup** in order to access individual tabs of settings.

To clear the password, enter any text in the **New Password** field, delete it, and save.

Setup > Wi-Fi

This *Setup* tab allows you to alter network settings for the connected RVS Camera. When configuring an RVS Camera for the first time, you will typically start here, replacing the default Access Point password before rebooting into Wi-Fi mode.



Changes to network settings are applied after power cycling the RVS Camera. This can be done by unplugging the power adapter or via the button under the *Setup > Factory* tab.

Access Point

Access Point (AP) mode disconnects the RVS Camera from Wi-Fi and sets up a static network with the following credentials:

- **Name** - RaynCamera-######, where the six characters are the camera's unique hexadecimal ID.
  - For example, **RaynCamera-CD2AB8**. Each camera's ID is unique.
- **Password** - Password

If the **Device Name** field is used to change the name of the camera, the named address used to access the camera will also change. The new address is previewed underneath the entered device name.

Once connected to the camera's network, the web interface for the camera can be accessed via a web browser by navigating to **http://10.1.2.1/**, the AP mode default IP address.

The RVS Camera will initialize in AP mode when powered up for the first time or if powered up without valid Wi-Fi credentials. You will be required to replace the default AP password with one of your own of at least eight characters.

Wi-Fi Client Station

In this mode, the web interface for the camera can be accessed via a web browser by navigating to either of the following:

- Your camera's name, including the hexadecimal ID. This option is not compatible with HTTPS, and may not be compatible with all routers or web browsers.
  - For example, http://RaynCamera-CD2AB8/. Each camera's ID is unique.
- Your camera's IP address. This option is not compatible with HTTPS.
  - For example, http://192.168.4.119/. Each camera's IP address is unique.

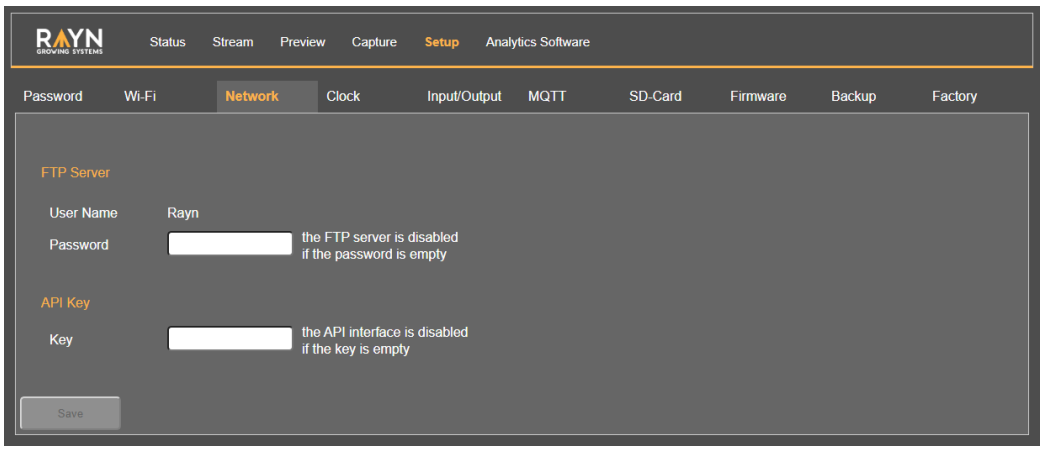
If the **Device Name** field is used to change the name of the camera, the named address used to access the camera will also change. The new address is previewed underneath the entered device name.

The RVS Camera must connect to a local Wi-Fi network and reboot into Wi-Fi mode. Enter the credentials of the Wi-Fi network you wish to join using the **SSID** and **Password** fields.

In a networked system of multiple RVS Cameras, all cameras must be in Wi-Fi mode.

Setup > Network

This *Setup* tab allows you to configure options to access your camera's remotely via FTP and API.



The following options are available:

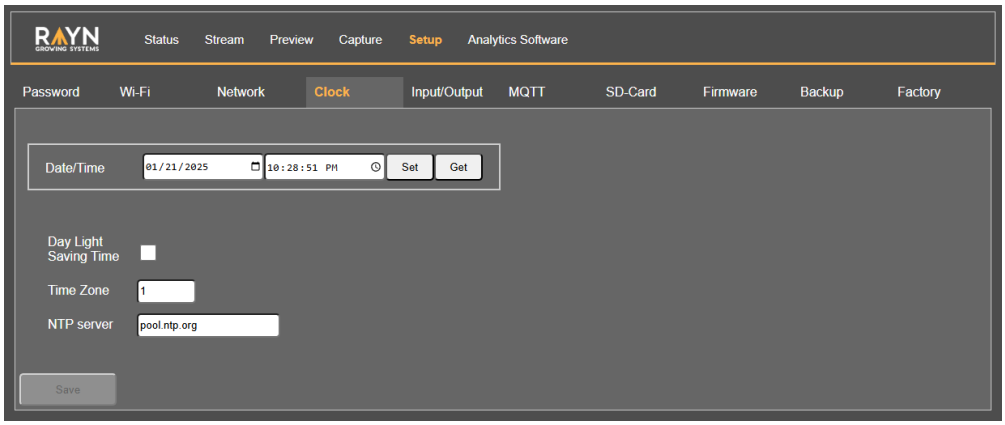
- **FTP Server Password** - enter a custom password to access and download images from the camera's SD card via FTP. Clear the password to disable FTP functionality.
- **API Key** - enter a custom key to access and remotely control the camera via API. Clear the key to disable API functionality.

To clear the password or key, enter any text in the respective field, delete it, and save.

Detailed API documentation is available at github.com/rayngrowingsystems/camera_api.

Setup > Clock

This *Setup* tab allows you to edit the current date and time settings.

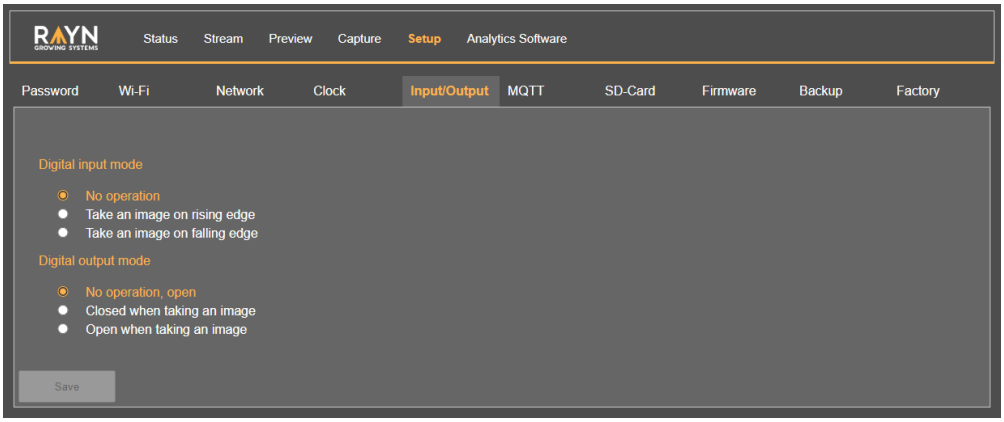


The following options are available:

- **Date/Time** - the current date and time. Use the **Set** button to manually set the date and time. Use the **Get** button to pull from the specified NTP server.
- **Day Light Saving Time** - when checked, enables daylight saving time.
- **Time Zone** - your current time zone number.
- **NTP server** - the server from which to retrieve current date and time information.

Setup > Input / Output

This *Setup* tab provides settings for the RVS Camera's digital 24 V input and contact output connections, which allow the camera to trigger or be triggered by external devices. The connections work independently from each other and can be used in conjunction.



Digital Input Mode

This option allows you to automatically take an image based on the detected digital 24 V input voltage. The following options are available:

- No operation - the camera will not respond to input voltage.
- Take an image on rising edge - takes an image when the voltage rises from 0 to 24.
- Take an image on falling edge - takes an image when the voltage falls from 24 to 0.

CAUTION: ***Connected control devices must be Class 2.***

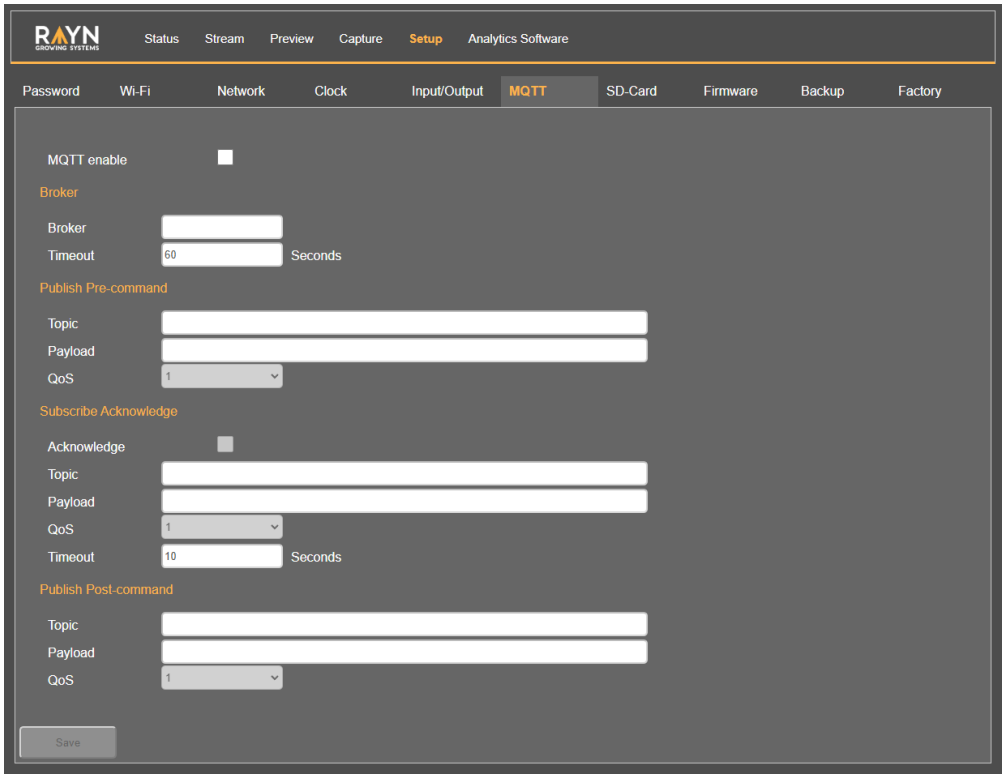
Digital Output Mode

This option allows you to automatically set the camera's contact output to open or closed when taking an image. The following options are available:

- No operation, open - the output stays open and is not affected when the camera takes an image.
- Closed when taking an image - closes the contact output when the camera takes an image. When the camera is idle, the output is open.
- Open when taking an image - opens the contact output when the camera takes an image. When the camera is idle, the output is closed.

Setup > MQTT

This *Setup* tab provides settings to enable and configure communication with MQTT devices in your system.



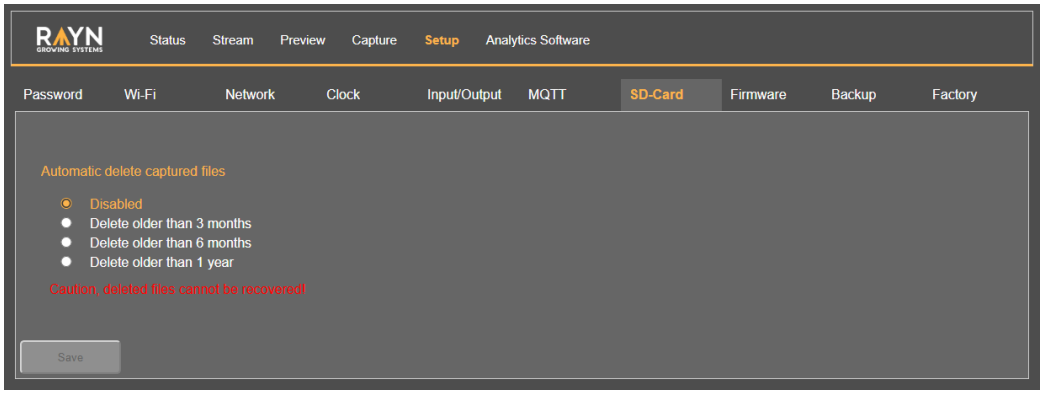
MQTT can be utilized to communicate with RAYN Syrcadia or other third-party control systems to turn off the lights before taking an image, as well as back on after the capture. For more information on communicating with Syrcadia, please refer to the *RAYN Syrcadia Software and RAYN Touch Controller User Manual*.

User documentation and technical support are available via our website, raynGrowingSystems.com, or by contacting your RAYN Growing Systems provider.

Please consult the relevant user documentation of any third-party device or control system.

Setup > SD-Card

This *Setup* tab allows you to configure automatic deletion of older captures from your camera's internal storage.



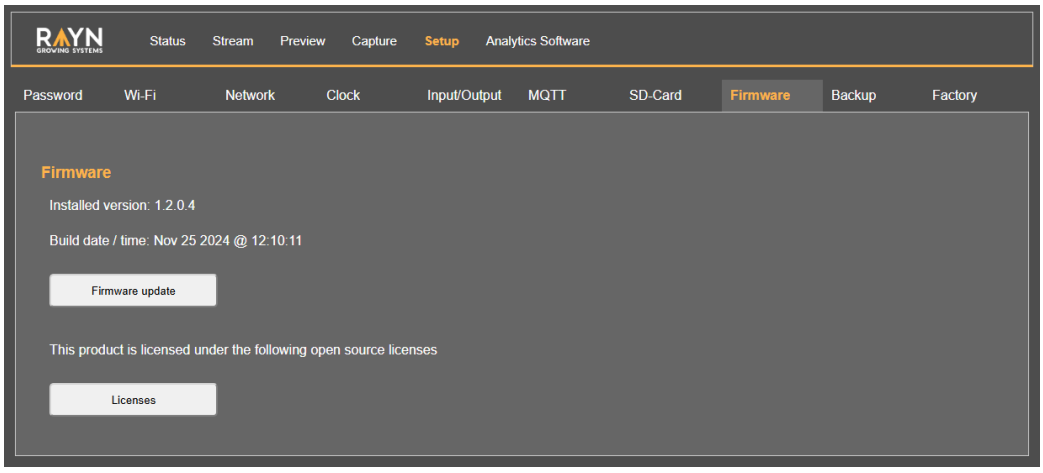
The following options are available:

- **Disabled** - files will not be automatically removed. Automatic deletion defaults to disabled.
- **Delete older than 3 months** - deletes captures taken more than three months ago.
- **Delete older than 6 months** - deletes captures taken more than six months ago.
- **Delete older than 1 year** - deletes captures taken more than a year ago.

CAUTION: ***Deleted files cannot be recovered.***

Setup > Firmware

This *Setup* tab displays the currently installed firmware version and the firmware's build date and time. The **Firmware update** button allows you to update the camera firmware to a newer version, if available.

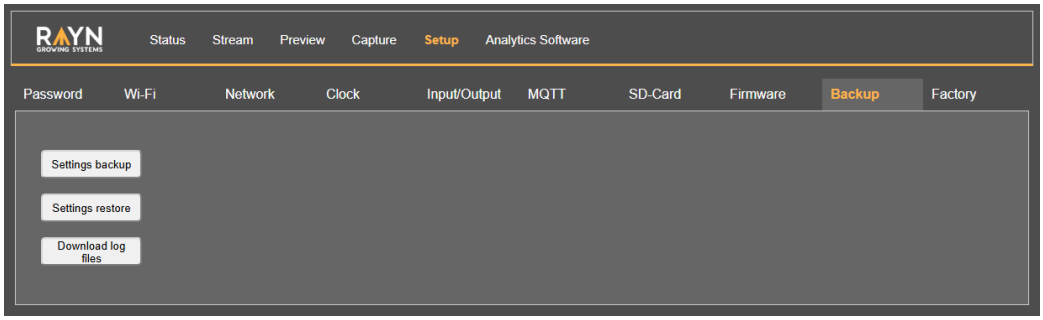


You can obtain new versions of the RVS Camera's firmware in .img format from your RAYN Growing Systems provider.

The **Licenses** button opens an online licenses overview on the website of RAYN Growing Systems' parent company, ETC, Inc.

Setup > Backup

This *Setup* tab allows you to either back up the current camera configuration to a new file, or restore settings from an existing file.

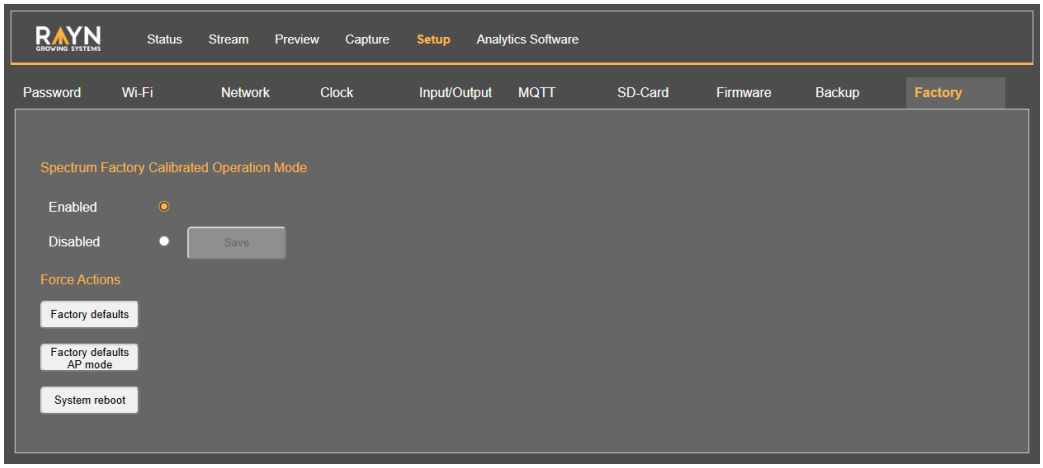


The following options are available:

- **Settings backup** - download a file of saved settings.
- **Settings restore** - upload a file of saved settings.
- **Download log files** - download camera logs for troubleshooting.

Setup > Factory

This *Setup* tab provides options to alter calibration settings, reboot your camera, or reset it to factory defaults.



Spectrum Factory Calibrated Operation Mode

RVS Cameras ship from the factory calibrated for image capture with the included lens and LEDs. Certain advanced setups may wish to disable this calibration and capture raw images.

The following options are available:

- **Enabled** - the camera will use the factory spectrum calibration when capturing images. Calibration defaults to enabled.
- **Disabled** - the camera will disable factory spectrum calibration for image capture.

Force Actions

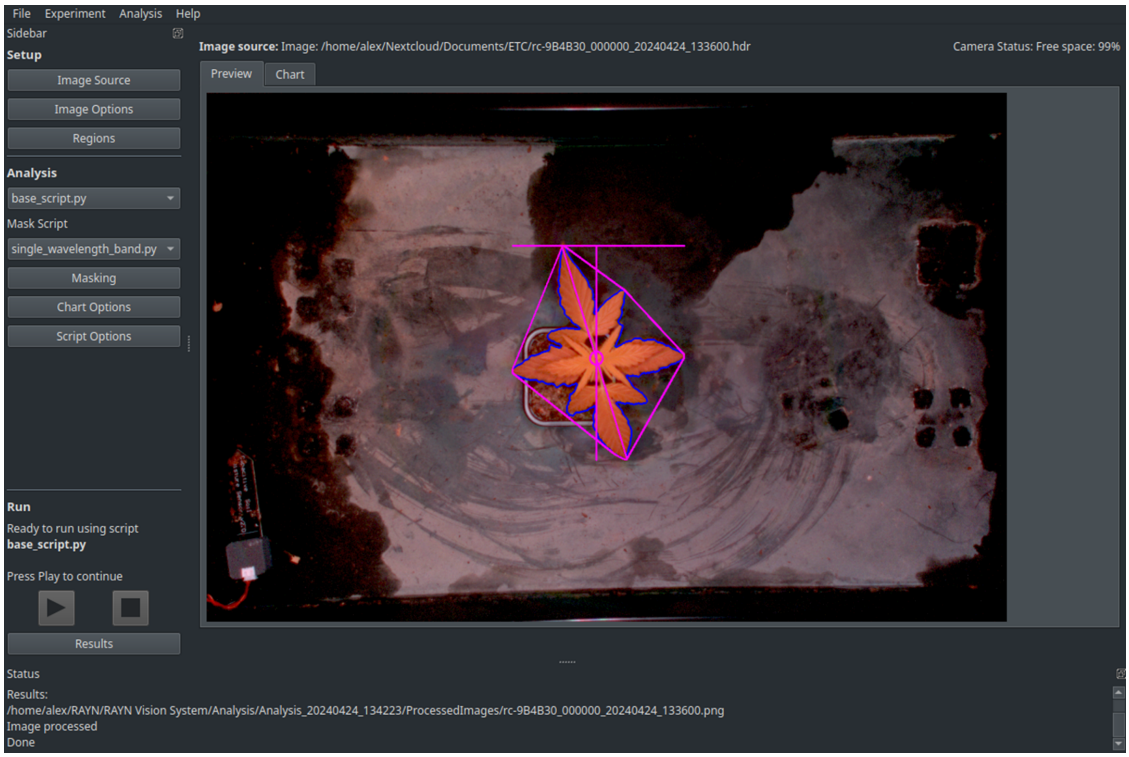
The following options are available:

- **Factory defaults** - resets the camera to factory default settings. All information will be erased, other than any entered Wi-Fi credentials. The camera will reboot.
- **Factory defaults AP mode** - resets the camera and erases all information, including Wi-Fi credentials. The camera will reboot in *Access Point* mode.
- **System reboot** - power cycles the camera.

RAYN Vision System Analytics

This top menu bar option opens the RAYN Growing Systems website overview of the RAYN Vision System Analytics software.

RAYN Vision System (RVS) Analytics is an open-source application for the processing and analysis of multispectral image cubes from multiple sources, including RVS Cameras online in the same network.



For more information, see the *RAYN Vision System Analytics Software User Manual* and *RAYN Vision System Analytics Software Release Notes*.

User documentation and technical support are available via our website, rayngrowingsystems.com, or by contacting your RAYN Growing Systems provider.