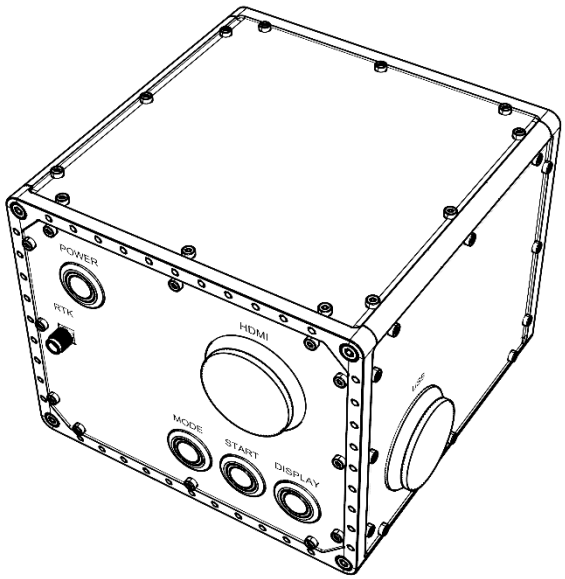
Spectral DEVICES INC.

Product Sheet

Super Spectral Multisensor Drone Camera



MSDC-2-4-SS-1-A
Version 01
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Specifications subject to change

Table of Contents

Table of Contents 2
Background information 3
Trademarks 3
Sales and Support 3
1. Description 4
2. Key Features 5
3. Specifications 6
4. Drawings 8
5. Package Contents 9
6. Software 9
Features 10
7. Image Post-processing 12

Background information

Trademarks

Spectral Devices Inc., MSDC, MSC2, MSDC-2-4, MSDC-2-4-SS-1-A

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1. Description

The multispectral drone camera is a turnkey multispectral imaging solution for easy integration into DJI M300 RTK drones enabling the capture of geotagged aerial images for further analysis in data mapping software.

Each MSDC-2-4 (Fig.1) includes up to 4 cameras with lenses optimized for customer specified field of view and ground resolution. A built-in vision computer provides a high degree of control over the cameras, ensuring synchronized operation and recording of images. The MSDC-2-4 comes with a built-in GPS and RTK base station enabling centimeter-level positional accuracy (Fig.2). The MSDC-2-4 also comes with a solar sensor providing up to 19 channels of spectral solar data along with sensor orientation. Although the system is designed to work with the DJI M300 RTK drone, integration on other drone models is possible if sufficient payload capacity and power is available.

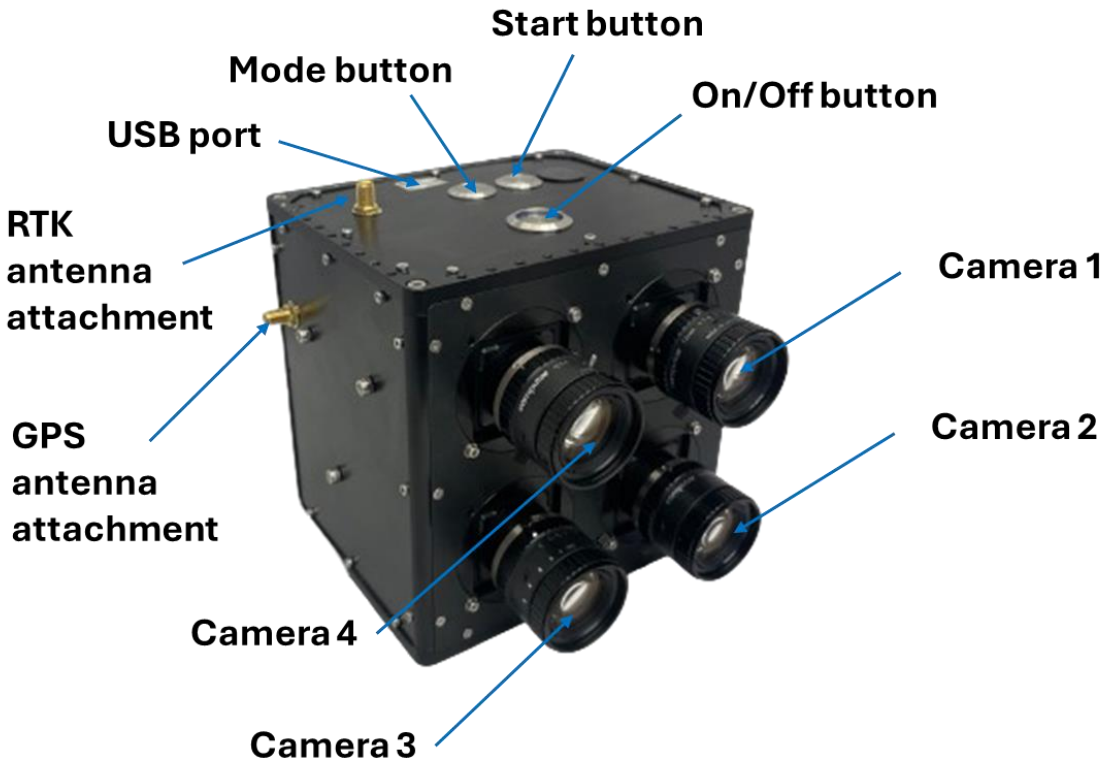

Figure 1. *MSDC 2-4 system (note: position of switches and access ports dependent on internal camera configuration)*

System configuration is performed using text-based configuration files on the USB drive. Operation is simplified to only two pushbuttons. Start and stop buttons control image capture on demand. A live multispectral video feed is available for downlink. Each MSDC-2-4 is energy-efficient, lightweight, and comes fully configured with camera control and image capture software.

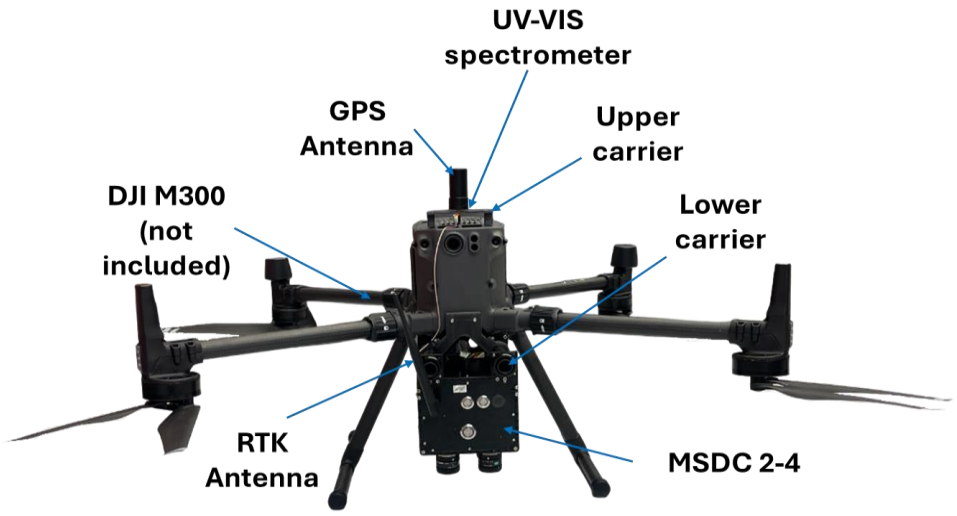

Figure 2. *MSDC system mounted on a DJI M300 drone.*

The MSDC-2-4-SS-1-A drone camera system is designed for exploratory work requiring a large variety of wavelengths. Cameras has 3 visible wavelengths (445, 532, 645 nm), 8 near-infrared wavelengths (720, 760, 800, 840, 860, 900, 940, 980 nm), 16 shortwave infrared wavelengths (1125, 1160, 1195, 1230, 1265, 1300, 1335, 1370, 1405, 1440, 1475, 1505, 1540, 1575, 1605, 1640 nm) and thermal camera operation between 8-12 µm.

2. Key Features

- Diverse Camera Array
  - 8 - band NIR camera
  - Thermal camera
  - 16 - band SWIR camera
  - 5 MP narrow band Color camera
- Seamless Integration and User-Friendly Design
  - Compatible with a wide range of drones capable of carrying a payload of 1.7 kg and supplying 9-36V DC power
  - Designed with user-friendliness in mind, ensuring ease of use even for those new to drone technology
- Built-in Vision Computer
  - Real-time HDMI output of multispectral images
  - Sustained frame rates of up to 1 FPS with simultaneous recording to USB drive
  - Over 4 h of sustained frame recording at 1 FPS with a 512 GB USB drive (12-bit mode)
- Built-in GPS
  - High performance GPS with 10 Hz update rate
    Includes RTK base station for centimeter-level accuracy and 20 km range
- Solar sensor
  - 19 channel spectrometer

  - Built-in IMU for orientation
  - Built-in directional sensor
- Enables comprehensive analysis of multispectral data
  - Agricultural and environmental monitoring: NDVI, GNDVI, EVI, MSAVI, NDWI, MSI, NDMI, NBI
  - Thermal monitoring
  - Structural and infrastructure inspections
  - Archeological exploration
- Advanced Post-Processing Software
  - The system comes equipped with sophisticated image post-processing software
  - Allows for radiometric correction of images, ensuring accuracy and reliability of data
  - Geotagging for precise location mapping
  - Support provided for orthomosaic map generation

3. Specifications

Table 1. *List of cameras in the MSDC-2-4-SS-1-A system*

CAMERA	TYPE	#BANDS	RESOLUTION/BAND	BANDS	BANDWIDTH (FWHM)
NIR	Area scan	8	256 x 256	720, 760, 800, 840, 860, 900, 940, 980 nm	20 nm
SWIR	Area scan	16	135 x 105	1125, 1160, 1195, 1230, 1265, 1300, 1335, 1370, 1405, 1440, 1475, 1505, 1540, 1575, 1605, 1640	5-45 nm
Thermal	Area scan	1	1280 x 1024	Thermal	8-12 µm
COLOR	Area scan	3	2448 x 2048	440 nm, 510 nm, 600 nm	110 nm, 130 nm, 80 nm

Table 2. *Specifications of the MSDC-2-4-SS-1-A system*

Lens compatibility	All Spectral Devices C-mount lenses
Thermal control	Passive conduction of camera heat to enclosure
Water-resistant	Yes (IP54)

Dust-resistant	Yes (IP54)
Cable access	External access to USB, HDMI, power cable, Solar sensor cable, GPS antennas (GPS antenna and RTK).
External construction	Aluminum with Stainless-steel hardware
Surface finish	Black anodization with laser etching
Cable entry	One or two Ø5-6mm cables through removable seal
Dimensions	136 mm x 136 mm x 110 mm (150 mm with lenses)
Weight	1.70 kg with lenses. 1.38 kg without lenses

4. Drawings

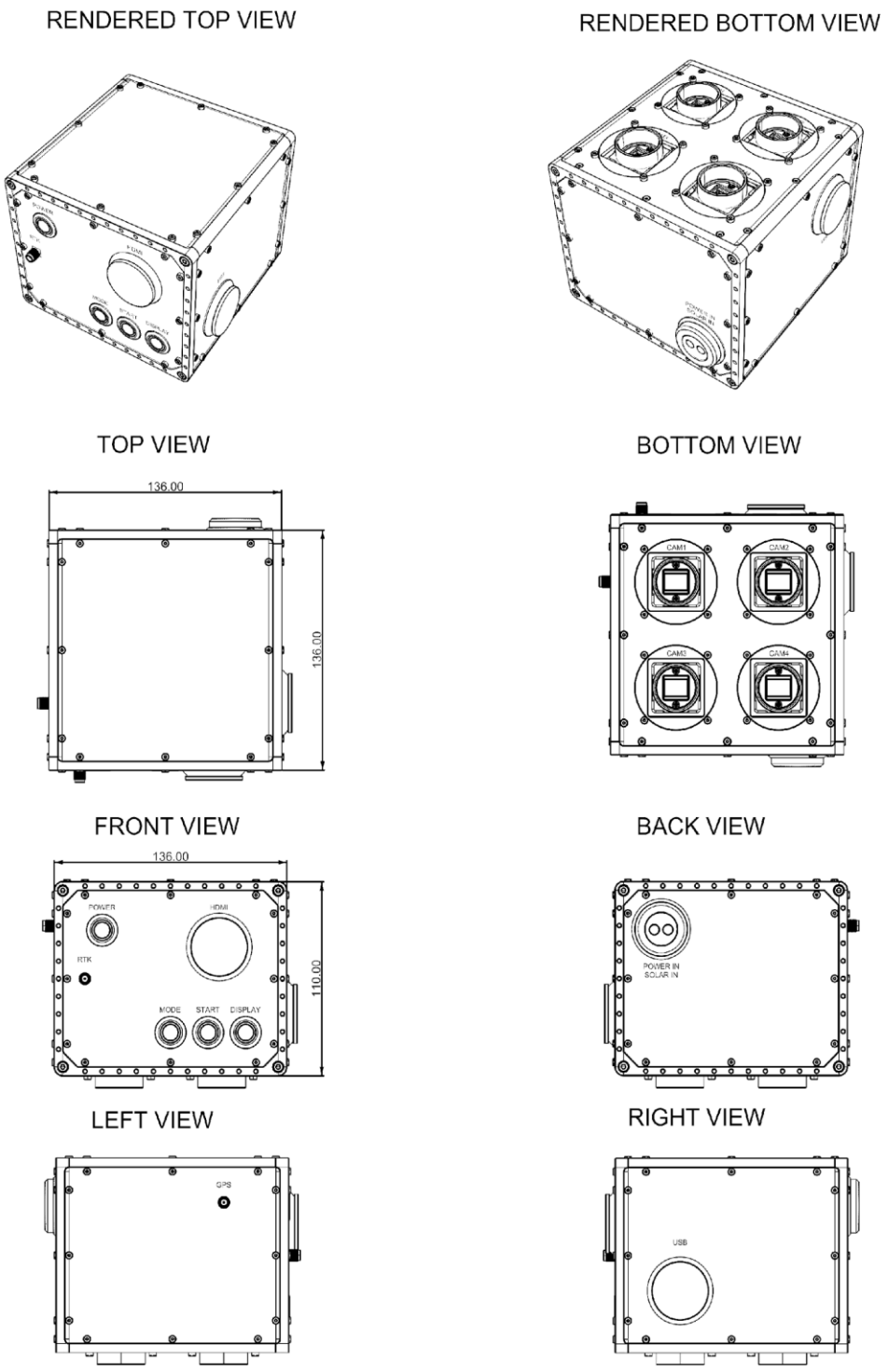

Figure 3. *MSDC system drawing.*

5. Package Contents

Package contents include the MSDC-2-4-SS-1-A camera system, RTK base station, drone upper and lower carrier, accessory pack (antennas), and sun spectrometer (solar sensor) (Fig.3 [Top]). All items supplied in a waterproof equipment case (Fig.3 [Bottom).

Figure 4. *MSDC system package contents.*

6. Software

With every MSDC-2-4, Spectral Devices provides msInspector, a Windows-based application featuring a graphical user interface (GUI). The software makes inspection and geotagging of images collected with the MSDC series multispectral drone cameras from Spectral Devices Inc quick and easy.

The software onboard the MSDC-2-4 performs real-time preprocessing of images from each camera. For example, multispectral images are demosaiced and saved in TIFF format onto the removable USB drive. While single band cameras, such as the SWIR are saved directly to the drive. Images are saved into a hierarchical folder system ensuring no data is overwritten between flights. msInspector uses configuration, calibration, and correction files specific to each MSDC camera. The calibration files are supplied by Spectral Devices. msInspector provides a series of batch operations

allowing the user to load images, solar sensor data, and GPS data. At each step, data can be visualized. The geotagged images can be saved to a folder chosen by the user.

Features

1. Simple, easy to use tabbed GUI.
2. Data visualization (images, GPS and solar sensor data)
3. Geotags large numbers of images in a single operation.
4. Tags solar sensor data to the images.
5. Exports geotagged images in multiple formats to the desired folder.
6. Provides tags required by 3rd party mapping software.

In the camera tab the user can review all the collected images and apply non uniformity corrections to the images (Fig.4).

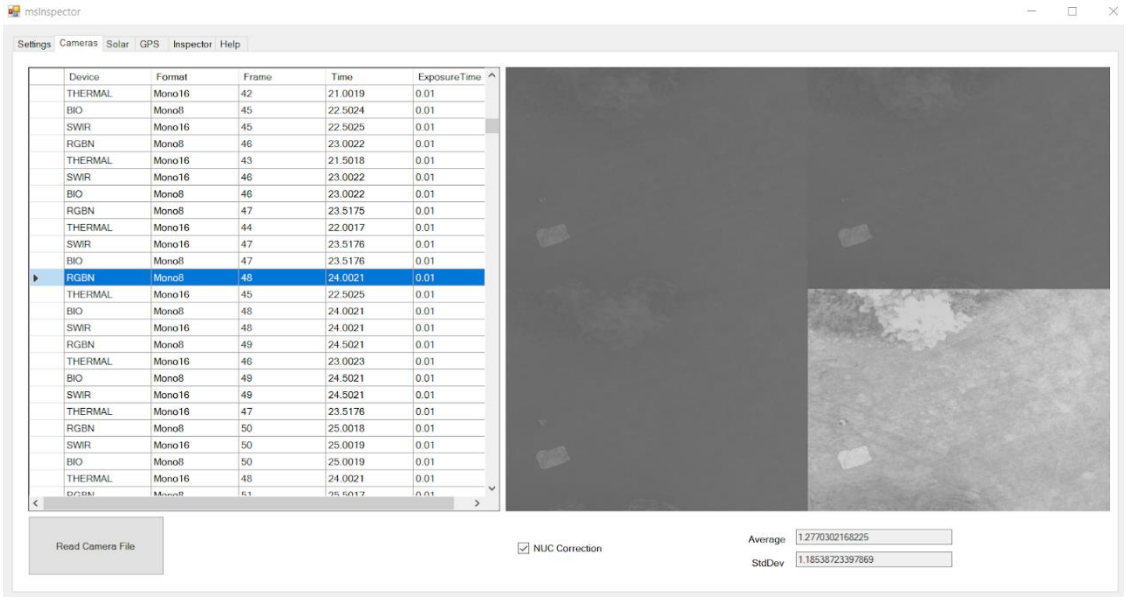

Figure 5. *Camera tab in the msInspector.*

Solar tab (Fig.5) in the msInspector allows the user to review data collected by the solar sensor during the flight. Data includes the spectrometer reading across the VIS-NIR spectrum, sensor orientation (yaw, pitch, roll), and solar direction relative to the sensor.

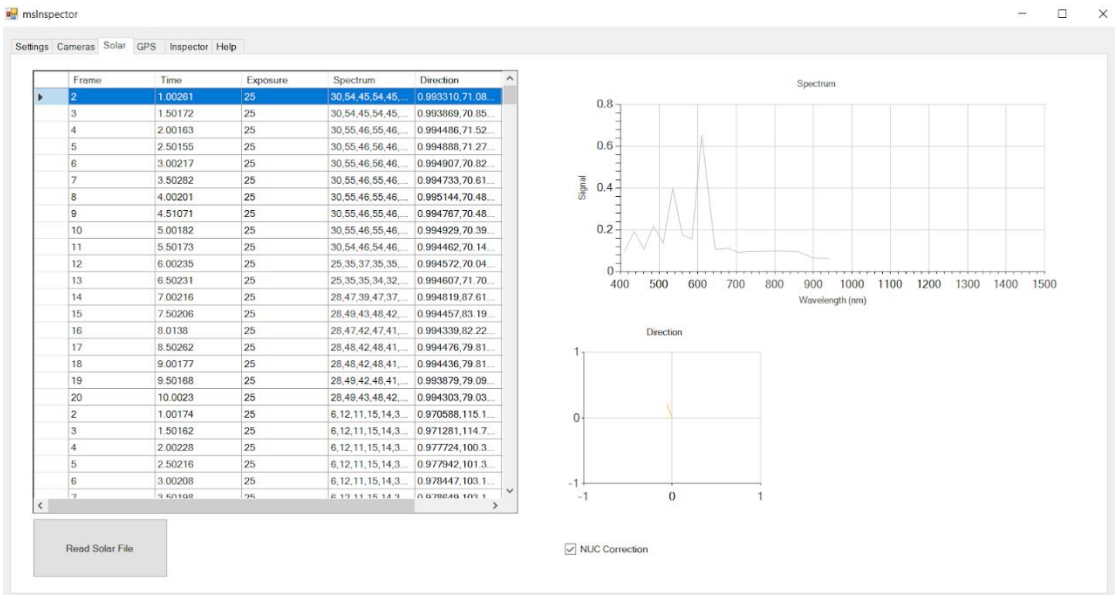

Figure 6. *Solar tab in the msInspector.*

GPS tab (Fig.6) in the msInspector allows the user to review GPS data collected by the GPS sensor (longitude, latitude, and altitude) during the flight. A map is displayed showing the location of the flight along with the flight path.

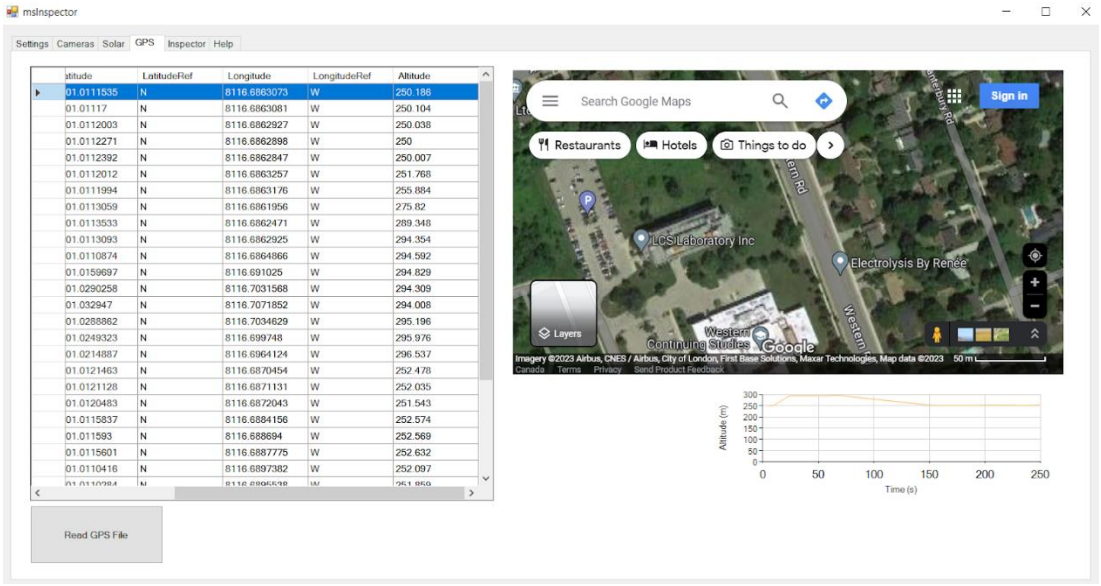

Figure 7. *GPS tab in the msInspector.*

The Inspector tab (Fig.7) in the msInspector allows the user to review all the data together. This data is used for image metadata generation. From this tab, geotagged images are exported with all the necessary metadata for image post-processing using software such as WebODM or Pix4DFields.

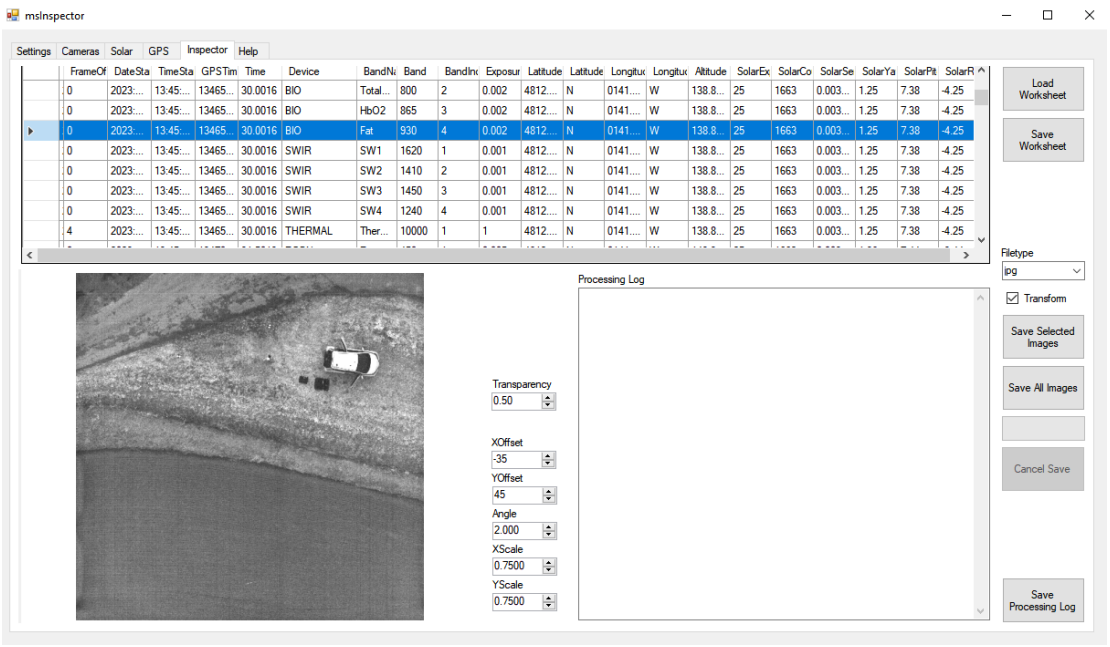

Figure 8. *GPS tab in the msInspector.*

7. Image Post-processing

Images exported from the msInspector are ready for 3D model reconstruction and orthomosaic map generation using open-source software WebODM by Open Drone Maps or subscription software Pix4D.

Spectral Devices Inc. provides tutorials and guides for image post-processing.