MicaSense Altum[™] and DLS 2 Integration Guide



Revision 04, October 2018



Seattle, WA

© 2018 MicaSense, Inc

Introduction

MicaSense Altum provides multiple options for integration - from stand-alone (where you only provide power to the sensor) to fully customized integrations. Advanced integrations take advantage of flexible interfaces including Ethernet, serial, RTK, and PWM/GPIO trigger, for seamless integration with any aircraft.

What's Included?

- Altum sensor
- DLS 2 sensor
- Edimax Wi-Fi adapter
- 128 GB external USB 3 compact flash drive (Samsung MUF-64BA)
- 14-pin Host interface connector (female) with pigtail cable interface for power, ground, trigger, comm interfaces, and DLS2 connector board
- DLS 2 connector cable
- Pelican case
- Lens cover (opaque not for use during operation)
- M3 x 0.5 screws, washers (QTY 4)
- M2 x 0.4 screws, washers (QTY 2)

Lens and Imager Information

	Multispectral	Thermal
Pixel size	3.45 um	12 um
Resolution	2064 x 1544 px (3.2 MP x 5 imagers)	160 х 120 рх
Aspect ratio	4 : 3	4:3
Sensor size	7.12 x 5.33 mm (8.9 mm diagonal)	1.92 x 1.44 mm
Focal length	5.5 mm	1.68 mm
Field of view (h x v)	48° x 36.8°	57° x 44.3°
Thermal sensitivity	n/a	< 50 mK
Output bit depth	12-bit	14-bit
GSD @ 120 m (~400 ft)	5.2 cm	81 cm
GSD @ 60 m (~200 ft)	2.1 cm	41 cm

Center wavelengths and bandwidth



Name	Center	Bandwidth
Blue	475 nm	20 nm
Green	560 nm	20 nm
Red	668 nm	10 nm
Red edge	717 nm	10 nm
Near infrared	840 nm	40 nm
Thermal	11 µm	6 µm

Measurements and Attachment Points

There are four M3 screw holes at 60 mm x 35 mm on-center. The sensor can be attached to the host aircraft using at least two of the four provided threaded mounting points and M3 x 0.5 screws. If using only two mounting points, it is important to choose two threaded points opposite of each other.



Length	82 mm
Width	67 mm
Height	64.5 mm
Weight	357 g

Configuration Options

There are two basic ways to configure Altum. The following summaries will help you choose the one that meets your needs.

Default



The default configuration uses the DLS 2's integrated GPS. Use the provided cable to connect the DLS 2 to the DLS 2 board on the HOST connector. Ensure the DLS 2's physical installation meets the requirements outlined later in the DLS 2 section of this guide. Provide a supported power supply to pins 1 and 2 on the HOST connector. For more details, see the HOST section of this guide.

DLS 2 with Aircraft GPS



For more control, communicate with Altum by HTTP (Ethernet, Wi-Fi) or MAVLink (Serial). The APIs can be used in lieu of the DLS 2 GPS to provide the sensor with a position and attitude data (from the aircraft GPS, for example). Anytime GPS data is sent to the sensor via the API commands, it will be written to the image metadata, overriding the DLS 2 internal GPS data for five seconds (or until another update is sent via the API).

HTTP Connection

Attach a USB Ethernet adapter or USB Wi-Fi adapter to one of the USB 3 ports. See the Sensor Firmware Guide for connection details and information. For HTTP API details, visit <u>https://www.micasense.com/api</u>

Serial Connection

Use the provided pigtail from the host connector cable to connect to your serial device. See the Input and Output section of this document for pin layout and details. Visit <u>https://www.micasense.com/api</u> to learn more about communicating with the MAVLink API.

Recommendations for Installation

The Altum should be installed such that it has a clear view of the area directly below the aircraft. The "cone" of the lenses, especially thermal, which has the widest field of view (57° HFOV), should be considered in the process of deciding where to mount the sensor on the aircraft or payload bay.

Avoid putting windows or covers in front of the thermal sensor. Many materials that are transparent in visible bands are opaque in LWIR (thermal), so any coverings may prevent data collection. Even materials that are mostly transparent in LWIR will negatively affect the radiometric accuracy of the sensor output.

The multispectral sensors feature a global shutter and can withstand some vibration without degrading image quality; nevertheless, we recommend vibration isolation between the sensor mounting platform and the aircraft.

Ensure that the sensor points straight down (with respect to the earth) at all times during flight. The best way to ensure this is to use a gimbal.

Airflow over all surfaces of the sensor is necessary for proper heat dissipation. Do not run Altum on the bench or in the field for extended periods of time without airflow. Do not completely cover or insulate the back surface of the sensor.

Normally, the sensor should be in landscape orientation. If you plan to mount the sensor in a portrait orientation, remember to swap the vertical and horizontal parameters in your mission planner.

Ensure that the sensor is completely protected during landing. Note that we do not recommend using a lens cover during flight as it can filter the wavelengths that the sensor measures. Instead, protect the sensor with a recessed installation or by using landing gear.

Use the provided lens cover when storing Altum, and do not set Altum lens-side-down as it will rest on and scratch the lenses.

More integration guidelines for the DLS 2 are in the DLS 2 section of this guide.

Input and Output



The Altum & DLS 2 sensor kit includes all necessary cables for integration. If extending the cables, ensure that the voltage at the camera is at acceptable levels as outlined in the "Powering" section of this guide.

Host Interface Connector (Power and Data I/O)



Connector type/part number: (provided as pigtail assembly with every Altum integration kit from MicaSense) Samtec - 14pin, 2.00mm Tiger Eye™: PN# T2M-107-01-S-D-RA-WT

© 2018 MicaSense, Inc

13 DLS RX CAM TXF	11 DLS AUX OUT CAM INF	9 DLS POWER	7 CAM HOST PPS IN	5 CAM RX HOST TX	3 CAM PPS OUT	1 POWER
14 DLS TX CAM RXF	12 DLS PPS OUT CAM PPS IN	10 DLS GND	8 ISO GND	6 TRIG IN	4 CAM TX HOST RX	2 GND

All HOST I/O is referenced to pin 8: isolated ground. Ensure that any connected PPS or Serial devices connect an isolated ground wire back to pin 8.

Power specifications

Voltage	4.9 V - 25.2 V
Standby	5.5 W
Average	7 W
Peak	10 W

Altum requires 5.0 V DC for operation, with a maximum operating voltage of 25.2 V. The supply must be able to provide 10 W (2 A @ 5 V) peak. Power can be provided to the sensor in two main ways:

- shared power from aircraft's main battery pack
- a rechargeable Lithium-Ion battery pack (a two-cell LiPo will provide optimal efficiency).

Because 5 volt USB battery packs can dip below 4.9 V, they should not be used to power the sensor. If using a battery pack, ensure that it conforms to the power specifications listed above.

Storage (USB)

Altum features two high-speed USB 3 ports which support USB 3 compatible devices. Tested, compatible devices include:

Edimax Wi-Fi adapter AmazonBasics and CableMatters Ethernet adapters Most USB external flash storage devices (thumb drives, hard drives, and others)

For details on how the sensor writes files to the storage device, see the File Storage section of the Sensor Firmware Guide

Capture Rate

Altum's capture rate is heavily dependent on the storage device. The Altum kit includes a 128 GB Samsung MUF-64BA drive. Using a USB 3 drive with a fast write rate will ensure the fastest capture rate possible (about one capture per second). When setting up a mission or flight plan, adjust the desired overlap, flight altitude, and speed so that the capture interval does not exceed the maximum capture rate (one capture per second).

Accessory Port (ACC)

The accessory port is not available for use at this time, but may be used as an expansion port in the future. When it is available, we will update this guide.

Automatic Capture/Triggering

Altum supports three methods for capturing images: Overlap, Timer, and External Trigger. To learn more about how to configure these settings, please see the Sensor Firmware Guide.

Overlap (recommended)

In overlap mode, when the aircraft climbs to within 50 meters below your target altitude, Altum will start capturing and only take a capture if it has traveled forward enough distance to ensure the overlap percentage you have specified. When the sensor's altitude is below 50 meters from the target altitude, the sensor stops capturing. Overlap mode only calculates the forward overlap, and cannot account for the side overlap, which must be calculated in a flight planner, using the sensor's field of view to create an appropriate row spacing.

We recommend this mode because it helps ensure proper overlap (75% or higher), which is essential in order to produce high-quality output when processing the data in standard photogrammetry software.

Timer

When in timer mode, Altum will capture according the timer period (which is every two seconds by default). If the timer period is set to less than one second, the sensor will capture as quickly as it can (about once every second). The capture rate is heavily dependent on the write speed of the attached storage device.

External Trigger

For more control, you can enable external trigger mode to talk to Altum by serial port, Ethernet, or Wi-Fi. See the HOST connector section of this document for detailed pin information.

PWM

The sensor can be triggered with either a rising-edge/falling edge pulse or a PWM signal (such as is typically used with standard servos). When using a PWM signal as the trigger, the sensor detects a transition from a "long" PWM to a "short" PWM (or vice-versa depending on the configuration setup of the sensor). When using PWM, <u>ensure that a dedicated ground is connected to the isolated ground pin 8 on the Altum</u>.

HTTP API (Ethernet and Wi-Fi)

The HTTP API is the most powerful way to interface to the Altum. You can use this API using either the Ethernet connector or the Wi-Fi access point.

The API is accessed via HTTP connection to port 80 at the sensor IP address. All data is exchanged in the JSON format.

The actual value of the IP address depends on the configuration. When accessing the sensor via its Wi-Fi access point, the sensor IP address will be 192.168.10.254. When the sensor is connected to an Ethernet network, the sensor IP address will be 192.168.1.83 by default.

The sensor can be commanded to take a capture by either a GET or POST request to the /capture URL.

For more information and examples, please see https://www.micasense.com/api

Serial API

The Serial API provides a MAVLink interface to the Altum. You can use this API by connecting your MAVLink-capable system to the host serial port on the sensor.

The API is accessed via serial messages in the MAVLink format. MAVLink provides an open data format for interaction as well as a suite of tools to assist the programmer in developing and testing the interface. Altum uses MAVLink v1.0 messages and communicates with the host at 57600 baud.

For more information and examples, please see https://www.micasense.com/api

Downwelling Light Sensor 2 (DLS 2)



The Downwelling Light Sensor (DLS 2) is an advanced incident light sensor that connects directly to Altum. During a mission, the DLS 2 measures the ambient light and sun angle for each of the five bands of the camera and records this information in the metadata of the TIFF images captured by the camera. This information can then be used by specialized processing tools (like Pix4Dmapper) to correct for global lighting changes in the middle of a flight, such as those that can happen due to clouds covering the sun.

In addition, the DLS 2 provides GPS data to Altum unless GPS data is provided from an external source as outlined earlier in this guide. If using an alternative GPS source, the GPS receiver will remain on at very low power (uBlox C/A code GPS @ 5 Hz).

Measurements and Attachment Points



Height	14.03 mm
Width	46.00 mm
Length	63.50 mm
Weight	49 g

© 2018 MicaSense, Inc

DLS 2 Connectors and Buttons

The sensor kit includes all required interface cables to connect to the DLS 2.



The LED camera status indicator mimics the LED signals on Altum. The signal types are outlined in the Sensor Firmware Guide. The camera trigger button will command a capture on the Altum. This is useful for capturing a preflight image of the calibration panel.



The RF connector is not available for use at this time but may be used as in the future. When it is available, we will update this guide.

DLS 2 Installation Guidelines

The DLS 2 should always be the highest object on the aircraft in order to avoid shadows or reflections. It contains an integral GPS sensor that may be utilized for geotagging of the Altum imagery if system GPS signals are not provided to the sensor by other means. Install the module where it will have a clear view of the sky, far away from any devices that could interfere with it (like a data link or video transmitters).

When the DLS 2 starts up, it attempts to calibrate, which requires it to be still and motionless. Ensure that there is no vibration or movement until the DLS 2 has completed this procedure, indicated by normal LED status lights (shown in the Firmware Guide).

Fixed-wing

Always install the DLS 2 at the high-point of the fuselage (if possible) to avoid any shadowing or reflections from aircraft fuselage or rotors.

Do not recess or embed the DLS 2 sensor body below the metallic base.

Local reflections could impact light sensor measurements. Avoid bright or metallic paint near the DLS 2 light sensor as this may interfere with incoming light values.

Multirotor

Install the DLS 2 on a rigid post such that it is the highest object on the aircraft, with a minimum of 5 cm above the rotor plane.

Ensure that there are no obstructions in the DLS 2's field of view to the sky, including propellers and other items on the aircraft.

Keep the DLS 2 away from the aircraft GPS. Installing the DLS 2 near the aircraft GPS may impact the aircraft's GPS reception.

Example Integration



Altum and DLS 2 on a Matrice 100. The sensor draws power directly from the Matrice. The DLS 2 is the highest object on the aircraft.

MicaSense Altum and DLS 2 Integration Guide

Revision 04, October 2018 MicaSense, Inc. Seattle WA 98103

- The contents of this guide are subject to change without notice
- MicaSense, Inc. assumes no liability for incidental or consequential damages arising from the use of this product, and any claims by a third party.
- Copying of the contents of this guide, in whole or in part is prohibited under the copyright law.