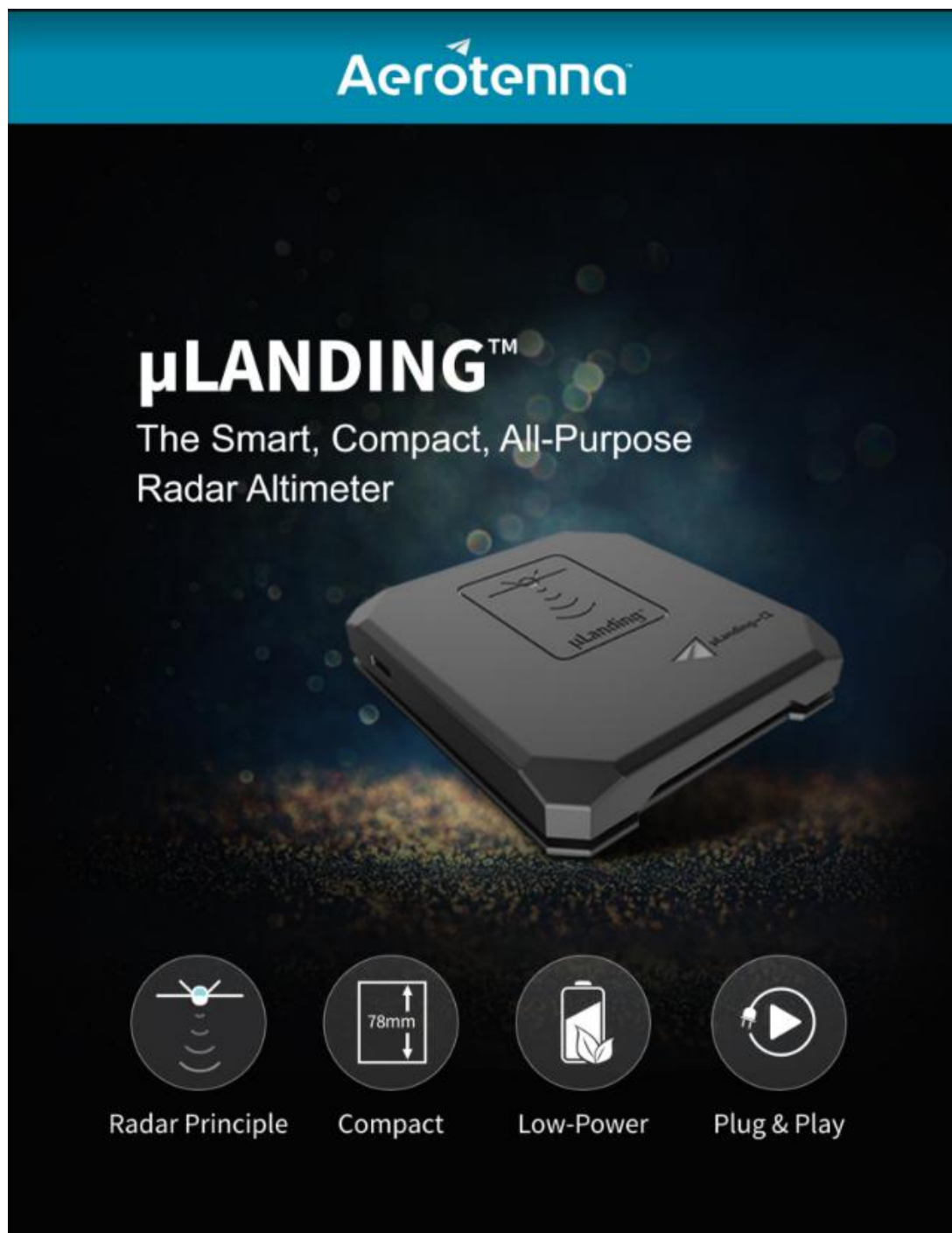


User's Manual/Installation Instruction



IMPORTANT NOTICE

FCC Regulation

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A device, pursuant to Part 15 of FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communication. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his/her own expense.

NOTE: Only peripherals complying with FCC limits may be attached to this equipment. Operation with non-compliant peripherals or peripherals not recommended by Aerotenna. Any modifications or changes to the product, not particularly approved by Aerotenna can void the user's authority to operate the equipment.

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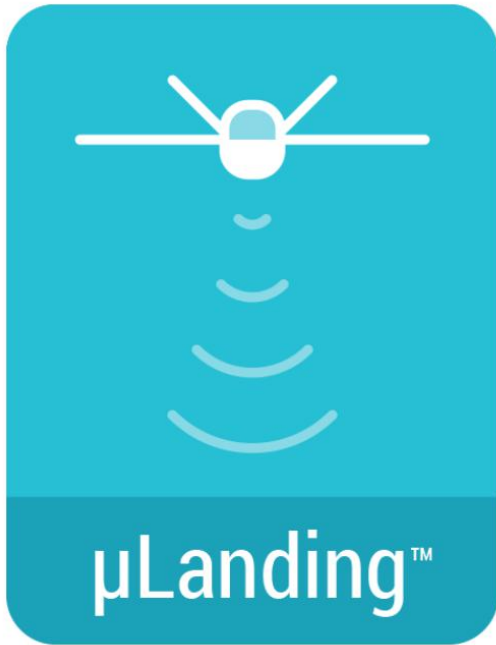
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What is μ Landing™ ?



The Smart, Compact, All-purpose Radar Altimeter

μ Landing™ is a miniaturized microwave radar altimeter that provides accurate above-ground-level (AGL) altitude information in real time. It can be used for autonomous takeoff, Landing™ and waypoint navigation for UAVs/drones as well as maintaining a target altitude during flight.

At 68 x 78 x 15mm and 30g (60g with enclosure), it's the smallest and lightest radar altimeter on the market and a great solution even for small drones.

Designed with the end user in mind, μ Landing™ is quick to install, easy to use and seamlessly interfaces with Aerotenna's OcPoC SoC flight controller or other flight controllers.

μLanding™ is a cost-effective, ready-to-fly solution used by drone makers, developers and service providers to enable:

- Autonomous takeoff and Landing™
- Waypoint navigation
- Maintaining target altitude
- Mapping and surveying over land and water and more!

Why μ Landing™ ?

Advantages of μ Landing™

1. Robust performance in any weather condition, making microwave sensing technology superior to IR and ultrasound
2. Superior capability at any time of day or night
3. Unparalleled flexibility over challenging terrains including water, bushes, crops, sand, etc.
4. Long range of up to 150m
5. High accuracy down to 2cm
6. Fastest update rate on the market for microwave radars
7. At 68 x 78 x 15mm, it's the smallest radar altimeter on the market
8. Super light weight (30g without enclosure) makes it ideal for drones of any size
9. Low power consumption of just 1.25W
10. Supports multiple I/O interfaces including GPIO, USB and CAN

Version Information

Product Name	Version	Users	Release Date
μLanding™ C1	V1.0	Commercial drone maker/users	Feb 2016
μLanding™ C1 Lite	V1.0	- Commercial drone maker/users - DIY drone users	Apr 2016
μLanding™ C1 Aqua	V1.0	Drone or boat application over water	Jul 2016
μLanding™ Pro	Under development	Commercial drone makers/users with long distance sensing requirement	TBD

μLanding™ C1 Specifications

Performance	
Maximum Altitude Range	45m
Altitude Accuracy	2.5-5cm
Maximum Update Rate	750Hz
Power Consumption	1.25W (5V, 250mA)
Operational Temperature Range	-55° to +85°
Operable Environment Conditions	All-Weather

Specifications	
Supported Interfaces	GPIO, CAN, USB
Communication	UART
Data Format	16-bit TTL Signal
Dimensions	68*78*15mm
Weight without Enclosure	30g
Weight with Enclosure	60g

μLanding™ C1 Lite Specifications

μLanding™ C1 Lite is the standard release version of μLanding™ with tuned sensing range from 0.25m to 50m and intuitive plug-and-play operation. The μLanding™ C1 Lite package comes with: 1) sensor unit 2) installation bracket.

Performance	
Maximum Altitude Range	45m
Altitude Accuracy	2.5-5cm
Maximum Update Rate	750Hz
Power Consumption	1.25W (5V, 250mA)
Operational Temperature Range	-55° to +85°
Operable Environment Conditions	All-Weather

Specifications	
Supported Interfaces	GPIO, CAN, USB
Communication	UART
Data Format	16-bit TTL Signal
Dimensions	68*78*15mm
Weight without Enclosure	30g
Weight with Enclosure	60g

μLanding™ C1 Aqua Specifications

Performance	
Maximum Altitude Range	45m
Altitude Accuracy	2.5-5cm
Maximum Update Rate	750Hz
Power Consumption	1.25W (5V, 250mA)
Operational Temperature Range	-55° to +85°
Operable Environment Conditions	All-Weather

Specifications	
Supported Interfaces	GPIO, CAN, USB
Communication	UART
Data Format	16-bit TTL Signal
Dimensions	68*78*15mm
Weight without Enclosure	30g
Weight with Enclosure	60g

μLanding™ C1 Pro

Performance	
Maximum Altitude Range	100m
Altitude Accuracy	10-12cm
Maximum Update Rate	750Hz
Power Consumption	1.25W (5V, 250mA)
Operational Temperature Range	-55° to +85°
Operable Environment Conditions	All-Weather

Specifications	
Supported Interfaces	GPIO, CAN, USB
Communication	UART
Data Format	16-bit TTL Signal
Dimensions	68*78*15mm
Weight without Enclosure	30g
Weight with Enclosure	60g

Quick Installation

About This Tutorial

Here we will explain the process of connecting μ Landing™ to your airframe. This tutorial does not discuss structure and function of μ Landing™ or any additional sensor interfacing. For these topics, please refer to the relevant documentation on www.aerotenna.com.

Easy Integration

Integrating μ Landing™ with your specific system or airframe is straightforward and simple. μ Landing™ is designed to detect the distance between the radar sensor and any physical reflector. The setup process has been drastically simplified, and all you need to do is install μ Landing™ on any aircraft and power it on.

What You Need

Here is a short list of hardware you will need to complete this tutorial:

1. Aerotenna μ Landing™
2. External 5V DC power
3. Receiver device with UART interface

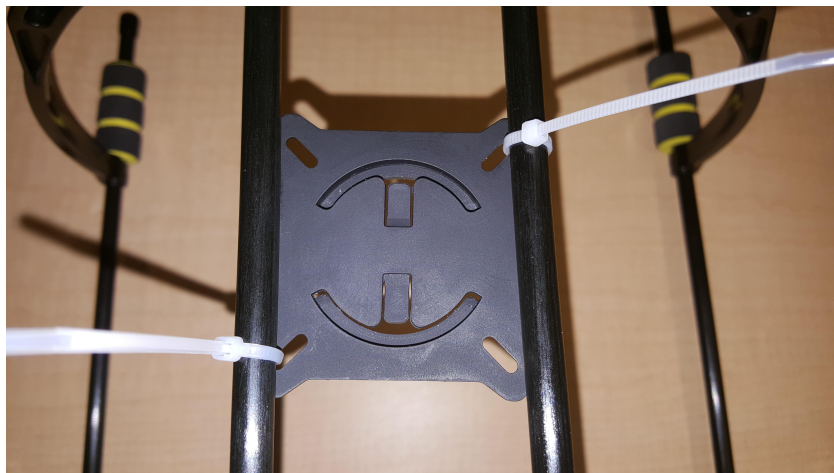
Hardware Installation

- STEP 1 -- Attach μ Landing™ to Airframe

Secure the base lock on the airframe or any other suitable position, ensuring that the fastener points down vertically (when airframe is standing upright).



μ Landing™ Base Lock



Secure the base lock on the airframe

Then, attach the secure μ Landing™ under the base lock.



screw μ Landing™ on the base lock

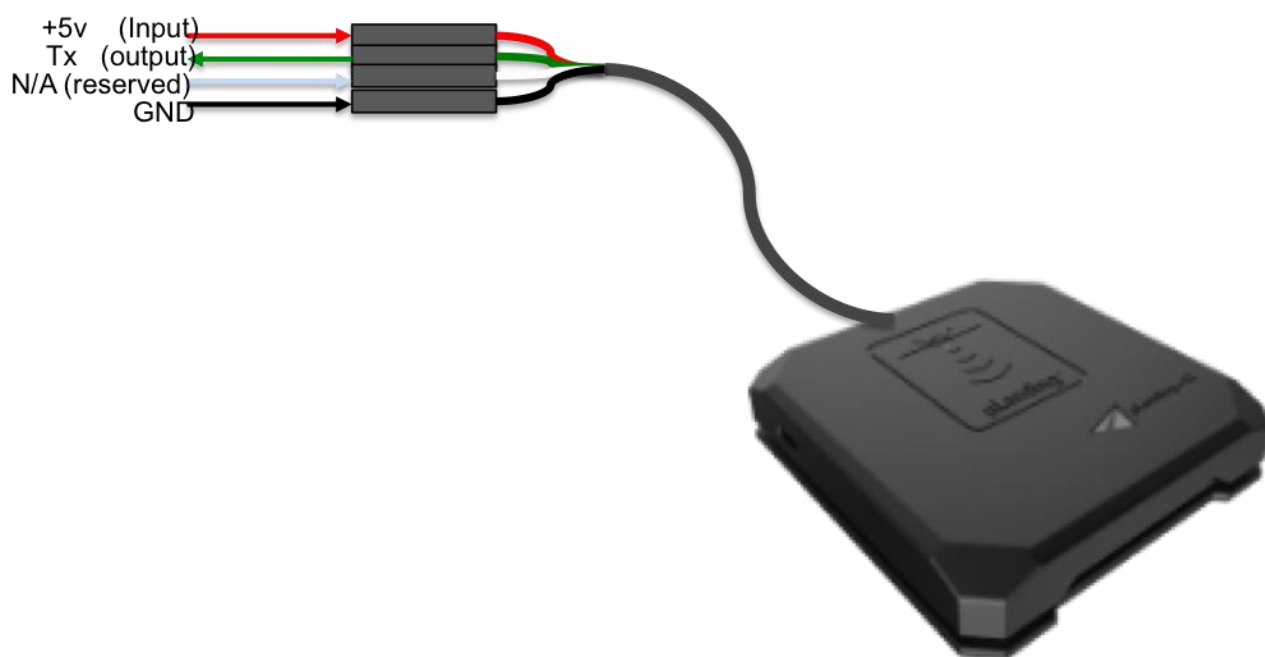
- STEP 2 -- Powering μ Landing™

Connect 5V DC power supply to the RED port and connect GND to the BLACK port.(connections shown below)

- STEP 3 -- Connection between μ Landing™ and Receiver Device

Connect your own receiver device to the GREEN port, it will automatically output data from this port.

(This is for general UART data format and protocol. for more data format and protocol options, please contact Aerotenna)



user interface on μLanding™

Receiving Data

This is the newest version of μ Landing™ 's data format and protocol.

The standard UART protocol is used for our serial transmission interface. The protocol can be modified based on your specific requirement. Contact us to request a change in data format and protocol or other requirements you may have with your system.

Communication Protocol

The communication protocol is:

- Standard UART
- Baud rate is 115200 b/s
- Data length is 8 bits, plus one start bit and one stop bit.
- I/O standard is 3.3V LVTTTL.

Data Format for Serial Transmission Interface

The frame of output data consists if 6 Bytes. The Byte structure is explained below. Note that an 'x' refers to a variable bit containing dynamic data.

Byte 1	0xFE	Packet Header
Byte 2	0x01	Version ID
Byte 3	0bxxxxxxxx	Altitude (Least Significant 8 bits)
Byte 4	0bxxxxxxxx	Altitude (Most Significant 8 bits)
Byte 5	0bxxxxxxxx	SNR (Signal to Noise Ratio)
Byte 6	0bxxxxxxxx	Checksum (formula below)

Explanation

Altitude

The altitude bytes can be combined (total 16 bits) to represent the altitude information in centimeters. The structure would be: 0x[MSB][LSB], where MSB and LSB are each two hex numbers (8 bits).

SNR

The altitude **reading** will be associated with SNR (normally range from 20 to 50) to indicate the quality of the reflections.

Checksum

The Checksum Byte could be used in the following check code:

```
if (Version_ID + Altitude_H + Altitude_L + SNR) & 0xFF == Checksum
is_valid = 1 (check passed)
else
is_valid = 0 (failed)
```

Integration References

This section gives integration examples with specific airframe to ensure that assembly is as simple as possible!

We have created a native Android app that can connect via Bluetooth to μ Landing™ (shown below). This can be run using Cordova on Android devices, or you can use Evotthings to deploy it on an iOS device.



Actual μ Landing™ reading using our native app

We are currently working on tutorials for integrating μ Landing™ with the following flight controllers:

- OcPoC
- Pixhawk
- APM

For more information about integration, please refer to our user hub.