A Hand e Made product

Alti-Force Sensor Pack

Setup and Operation Guide

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Installing Software – version 2.0+

Before using the Alti-Force Sensor Pack with your camera, Alti-Force software needs to be installed on the camera. Visit altiforce.net/support from your computer to download the latest Installer version.

Please note that when any update is performed, *you do so at your own risk*, knowing that unexpected errors may occur that could render the camera inoperable (but camera recovery methods are available).

Follow these easy steps to proceed with the install:

1. Start with a fully charged camera battery.
2. If the memory card is new, format the card in the camera.
3. Remove the memory card from the camera and connect card to computer (via card reader adapter).
4. Download the Installer (in compressed/zipped file format) from altiforce.net/support and save it to the memory card in the top level folder (also called main or root folder, e.g. F:\).
5. Extract (unzip) the Installer to the memory card in the top level folder (**not a subfolder!**).
6. Run (double-click) the unzipped installer program from the memory card and follow the on-screen instructions.

   Note: If the installer does not run, Java™ may need to be installed on the computer. The latest version is available for free at java.com/download.

   Note: The installer will require internet access to download the camera manufacturer's software, unless the correct "update.zip" file is already saved on the memory card.
7. Insert the memory card into the camera and power on the camera.
8. The camera screen will indicate status of the software update. Wait for the update to complete.
   Note: The camera will reset itself several times while updating. Do NOT remove the battery!

Uninstalling Software

The Hero3 Black and Hero3+ Black cameras require running the uninstaller program before performing any factory update. The uninstaller program is available at altiforce.net/support.

The Hero3+ Silver and Hero4 Black or Silver cameras need only to perform the factory update, which also uninstalls the Alti-Force software.

Note: After performing an uninstall or a factory update, the Alti-Force Sensor Pack will no longer function with the camera.

Quick Start

1. Start with the camera completely powered off, including Wi-Fi, then attach the Alti-Force Sensor Pack to the back of the camera.

2. Power on camera and wait a few seconds for the top LED (by record button) to blink red 3 times, indicating the sensor pack is discovered and ready.
   This step may be skipped if using QuikCapture mode on Hero4 (software v2.11+ required), and data will not appear for first 5-10 seconds of video.
   Note: LED blinks for sensor pack status occur after, and in addition to, standard camera LED indication.

3. If Alti-Force GPS mobile app is used, power on Wi-Fi to connect to the mobile device (Wi-Fi setup with official GoPro app must have already been completed), then start data broadcast on the mobile app. If a GPS expander board is used, wait to record until GPS signal is locked on. Verify the camera is receiving GPS data, indicated by the top LED (by record button) blinking blue once or twice per second (only while camera is in standby, not applicable if using QuikCapture mode).

4. Record video as usual.

5. After stopping each video recording, wait a few seconds for the top LED to again blink red 3 times before starting the next video recording.

6. To watch videos with subtitles on a TV, connect the camera to compatible TV via a USB cable then select USB input on the TV. Select the video to play (browse into DCIM folder, if necessary).
   To watch videos with subtitles on a computer, connect the camera to computer via a USB cable then open the video files (.MP4) with a compatible player. A memory card reader may also be used.
   Note: Windows® Media Player and QuickTime do not natively support subtitle tracks as .SRT files. Software plug-ins may be available, otherwise download the free VLC media player at videolan.org.

Subtitle Display

Line 1: Altitude | Alt. Change Rate | Temperature | Total Force (G)

Line 2: Force on each axis X: (G) Y: (G) Z: (G)

Line 3: G-bar (vertical bar scale of total force)

Line 4*: GPS Speed | Distance | Heading

Line 5*: Distance | Glide

Line 6: Digital markers

Font, color, and positioning depends on player settings
*Line 4 & 5 available only with Alti-Force GPS (mobile app or EB33)
*Distance on line 5 if speed_type=both. Empty lines are not displayed

Selecting Subtitles to Display

The subtitles shown on screen are **selectable prior to recording video**.   The subtitle options are stored on the memory card in a file named "settings.txt". This file can be modified manually, or preferably, by running the Settings Application, which is also stored on the memory card as a file named "settings.jar".   Notes: The Settings Application file is saved to the memory card when camera software is first installed. If it has been deleted, another copy can be downloaded from altiforce.net/support.

The Settings Application can be used to repair or replace the settings.txt file that has been deleted or manually saved while containing errors. Default values will be used by the camera if settings file errors exist during a video recording.

ALTITUDE

Altitude display

The altitude display choices are: Feet, Meters, Both, or None. The installed default is Feet.

The displayed altitude is an estimated value based upon air pressure measurements. Since air pressure changes can occur frequently, the estimated altitude at one location may also vary significantly in a short amount of time. To account for these changes, or to simply set a reference altitude/elevation, an offset can be entered **prior to recording video** to affect the subtitle value displayed for altitude.

Ground Offset

The offset value is entered in whole integer feet only. The installed default is zero.

The offset value is subtracted from the pressure-based altitude before displaying the final altitude estimate. The offset value is saved on the memory card in a file named "alt_offset.txt", which can be deleted to reset the offset to zero feet.

An offset value can also be saved from the camera, by which a measurement is recorded of the current estimated altitude, effectively setting the altitude to zero. To do so, press Mode (front button) until the camera shows the setup screen (wrench or gears), then press and hold Select (top button) until top LED begins to blink red, then release Select.

Smoothing

The altitude smoothing choices are: High, Medium, Low, or None. The installed default is Medium.

The smoothing filter is a moving average calculation of sampled data over a duration of time. The time durations for low, medium, and high are approximately ½ , 1, and 2 seconds, respectively. The smoothing setting is used only for displayed subtitles and will not change the actual data stored in the CSV data file.

ACCELERATION

G-force display

The G-force display choices are: Full, Total Only, XYZ Only, or None. The installed default is Total Only.

The acceleration is directly measured by a 3-axis sensor and displayed to one decimal place in units of "G" (1.0 G = 1 times Earth's gravity).   Displaying G-force to two decimal places is possible only by manually modifying the settings.txt file as documented within the file. If the installed default of one decimal place is used, it will be hidden from the settings.txt file.

G-Bar display

The G-bar display choices are: Yes or No. The installed default is No.

The G-bar is a visual scale of vertical lines that grows and shrinks horizontally as the total G-force increases and decreases.

Smoothing

The acceleration smoothing choices are: High, Medium, Low, or None. The installed default is Low.

The smoothing filter is a moving average calculation of sampled data over a duration of time. The time durations for low, medium, and high are approximately ½, 1, and 2 seconds, respectively. The smoothing setting is used only for displayed subtitles and will not change the actual data stored in the CSV data file.

ALTI-FORCE GPS (Hero4 only)

The Alti-Force GPS settings are employed when using the Alti-Force GPS mobile application or GPS Expander Board along with the Alti-Force Sensor Pack and GoPro Hero4 camera. These data can be displayed or saved only when GPS signal is being acquired. See more mobile device operational information in mobile app section.

Speed display

The GPS speed display choices are: MPH, km/h, or None. The installed default is MPH.

The displayed speed is referred to as ground speed, which is the horizontal speed of travel disregarding changes in altitude or elevation.

Distance display

The GPS track distance display choices are: Miles, km, or None. The installed default is Miles.

The displayed distance is the total accumulated distance traveled since the start of video recording. The mobile app displays ground distance, and the expander board includes vertical changes to display 3D distance traveled.

Heading display

The GPS directional heading display choices are: Yes or No. The installed default is No.

The displayed heading is the compass direction in degrees calculated between successive GPS position coordinates. Heading data is available when using the mobile app only, not with the GPS Expander Board.

Glide display

The GPS glide display choices are: Yes or No. The installed default is No.

The displayed glide is the ratio of vertical speed over horizontal speed. Glide data is available when using the GPS Expander Board only, not with the mobile app.

Speed type

The GPS speed type (direction) choices are: Horizontal, Vertical, or Both. The installed default is Both.

The displayed speed is separated into horizontal (H:) and vertical (V:) components. Speed units are chosen with *Speed display* setting. Vertical speed subtitles and data are available when using the GPS Expander Board only, not with the mobile app.

Save GPS track

The save GPS track choices are: Yes or No. The installed default is Yes.

The data is saved as an XML file in the GPS Exchange format, or GPX file, which can be loaded into many mapping programs to view the path traveled. Some GPS data will be included in the CSV data file regardless of this setting.

OTHER SETTINGS

Temperature

The temperature display choices are: F (Fahrenheit), C (Celsius), or None. The installed default is None.

The displayed temperature measurement is taken from inside the case of the Alti-Force Sensor Pack where temperatures are often higher than and change slower than the outside air temperature. The temperature sensor should not used for precisely measuring outside air temperature.

Save CSV data file

The save CSV data file choices are: Yes or No. The installed default is No.

The data contains comma separated values of all data points measured by the sensor pack during a video recording. Measurements from all sensors are included regardless of other subtitle settings. The file also contains additional information for converting each data source into specific engineering units.

ADVANCED SETTINGS

Advanced settings are intended for special use cases to extract the most data from the Alti-Force equipment. These settings can only be changed by manually editing and saving the "settings.txt" file located on the memory card used by the camera.

Subtitle Update Rate

The subtitle delay has a range of 0-10000 milliseconds. The installed default is 150 and will be hidden.

The subtitle delay is used to limit the number of subtitle updates during video playback by setting a minimum time that must elapse before changing the text displayed on-screen. Decreasing the value will increase the update rate; however, some players are unable to keep up with rates faster than the default. Changing the delay between subtitle updates is possible only by manually modifying the settings.txt file as documented within the file.

Acceleration Resolution

The acceleration resolution choices are: 1 or 2. The installed default is 1 and will be hidden.

The displayed value of G-forces can be shown with 1 or 2 places to the right of the decimal place. Note that increasing the resolution does not increase the accuracy.

Discrete-input Display

The discrete-input display choices are: Yes or No. The installed default is No and will be hidden.

The displayed subtitles will show a 0-3 volt input voltage state as a '0' for low or '1' for high voltage of the camera input pins labeled ID1 and ID2. Caution should be taken when making connection to these or any other direct camera input pins, and the user takes sole responsibility for all outcomes, which may include irreparable damage to the equipment. If an expander board is used, pull-up resistors may be included so the user need only to connect to ground for '0' or leave unconnected (floating) for '1'.

Vertical Speed by Pressure Altitude

The speed display has a window range of 0-250 samples. The installed default is 0 (disabled) and will be hidden.

The displayed subtitles will show the vertical speed based on pressure altitude changes. The speed window value is the number in history of smoothed altitude samples used to calculate the smoothed vertical speed. This speed display is accurate for steady state conditions and using too high of a value will make speed updates lag significantly during transient states of speed changes. For general use, it is recommended to use a value of 50-75 combined with an Altitude Smoothing level of medium or high.

GPS Distance Resolution

The GPS distance resolution choices are: 1 or 2. The installed default is 1 and will be hidden.

The displayed value of distance can be shown with 1 or 2 places to the right of the decimal place. Note that increasing the resolution does not increase the accuracy.

GPS Lag

The GPS lag compensation has a range of 0-9000 milliseconds. The installed default is 500 and will be hidden.

Increasing this value shifts each GPS data point to an earlier timestamp on the video and in the CSV data file. The GPS lag between the mobile app and camera varies by phone manufacturer and model. Fine-tuning from the default value is optional.

EXPANDER BOARD SETTINGS

Expander board settings are extra options available when using the Haptics or GPS Expander Boards. These settings (except haptics) can only be changed by manually editing and saving the "settings.txt" file located on the memory card used by the camera.

Haptic Feedback

The haptics choices are: Yes or No. The installed default is Yes.

When enabled, the haptics motor will vibrate to mimic the Alti-Force status LED. Three flashes/buzzes when ready after the camera powers on, one long flash/buzz when recording starts, and three flashes/buzzes after recording stops and Alti-Force is ready for the next video.

GPS Navigation Mode

The navigation mode choices are: 0,1,2,3,4,5, or 6. The installed default is 5.

The modes are as follows: 0-auto, 1-pedestrian, 2-car, 3-marine, 4-balloon, 5-airborne, 6-quadcopter.

The GPS receiver uses these modes to deliver the most accurate data for the specified activity. General use for ground-based activities may use mode 2, but mode 5 is suggested for activities with altitude changes. The automatic selection offered by mode 0 is not recommended for airborne activities, as it may not change modes quickly enough to match your action.

GPS Update Rate

The GPS rate (position updates per second) choices are: 1,2,4,5,8,10,20, or 25 Hz. The installed default is 25.

The higher updates per second yield best results in open sky conditions with unobstructed antenna, such as marine or airborne locations. A slower update rate may be chosen in areas of poor GPS signal reception.

GPS Speed Maximum

The speed limit has a range of 16-3220 km/h. The installed default is 483 (300 mph).

When the calculated speed between GPS position updates is faster than this value, the associated distance calculated will not be added to the total distance traveled. This is useful to limit large distance errors in cases of poor GPS signal and accuracy. This value should be set higher than the fastest speed expected.

GPS Distance Update Interval

The update interval choices are: 1 - 1500. The installed default is 50.

This value sets the number of GPS position updates received before the total distance traveled will accumulate. The calculated distance total will be more accurate with less frequent updates, especially while traveling at slower speeds. (example: <gps_dist_interval> / <gps_rate> = 50 / 25 = 2 seconds between distance updates)

Alti-Force GPS

WI-FI GPS - MOBILE APP

The Alti-Force GPS mobile app works only with the GoPro Hero4 camera and the Alti-Force Sensor Pack to add GPS-based data of speed, distance, and direction traveled to video recordings. The Alti-Force GPS mobile application also provides Hero4 camera controls to start and stop video recording over Wi-Fi.

Alti-Force GPS uses a mobile device to receive a GPS signal and broadcast the data over Wi-Fi to a Hero4 camera equipped with the Alti-Force Sensor Pack. The additional GPS-based data can be displayed as subtitles with the usual time-synchronized Alti-Force Sensor Pack data.

GPS Reception & Broadcast

Alti-Force GPS requires a GPS signal to be received by the mobile device to broadcast data.   Every device manufacturer internally sets the GPS to report data to mobile apps in their own way, which may have errors. As such, the quality of GPS data may vary by manufacturer and in cases of poor GPS signal and accuracy. Additionally, there is an unavoidable delay from when the mobile device receives the GPS signal until the camera receives the Wi-Fi data. This GPS lag between the mobile app and camera varies by device manufacturer and model. An advanced subtitle setting is available for adjustment, if desired.

Wi-Fi Connection

Alti-Force GPS requires Wi-Fi to connect to the Hero4 camera. In order to do so, the Hero4 camera Wi-Fi must already be set up with a network name (SSID) and password. If the Hero4 camera Wi-Fi has not been set up, or the name or password needs to be changed, the official GoPro app is required to perform the setup or make the changes. The Alti-Force GPS app cannot be used to set up or change camera Wi-Fi settings.

The Alti-Force GPS mobile app will indicate if the Wi-Fi is connected to a camera or other network (based on IP address). If your mobile device refuses to connect to the camera before other networks, you will have to "forget" the other network or "manage networks" to move the camera's network name to a higher priority.

Note that while Wi-Fi is connected to the camera, Wi-Fi access to the internet is not possible. Other mobile apps that try to sync or access the internet through Wi-Fi may show connection errors or simply not work until they regain data access on a regular (non-camera) network.

Menu

Introduction

The welcome screen is shown when the app is first installed. The overview contains a quick-start list of operation steps. The welcome screen can be viewed within the app at anytime by selecting 'Introduction' from the menu.

About

The about screen contains the mobile app version number and links for the Alti-Force website and support.

Settings

The Alti-Force GPS mobile app has a few user settings that process the GPS data before broadcasting to the Hero4 camera.
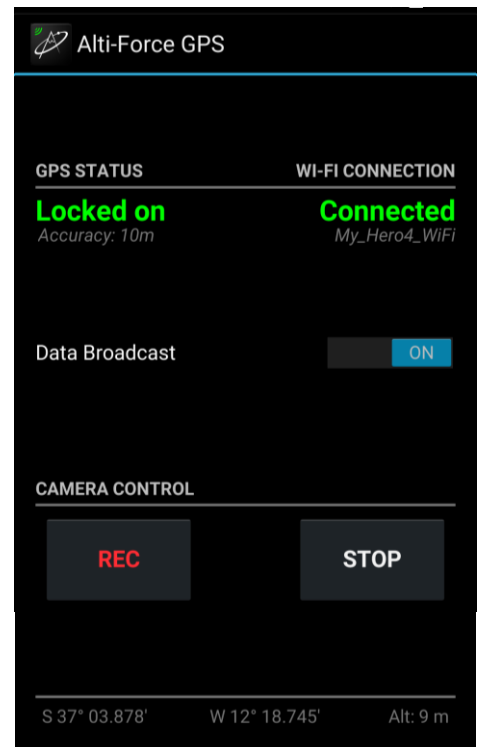
Position-based speed

Selecting this option causes ground speed to be calculated from successive GPS coordinates instead of using the speed reported by the mobile device. Every device manufacturer sets the GPS to report data in their own way, which may have errors. This is an alternative speed calculation; however, the resulting speed is susceptible to errors inherent from poor GPS signal and accuracy.

Distance update interval

This value sets how frequently the total distance traveled will update. The calculated distance total may be more accurate with less frequent updates, especially while traveling at slower speeds.

Maximum speed

When GPS speed is faster than the value selected, the most recent distance traveled will not be added to the total distance traveled. This is useful to limit large distance errors in cases of poor GPS signal and accuracy.

Powersave timeout

When Wi-Fi remains disconnected from a camera for this time duration, data broadcast is automatically turned off. This helps to save your mobile device battery power in case you forget to turn off data broadcast.

Location sources

Opens the mobile device's location settings menu. This is where you can turn on/off the GPS receiver of the mobile device.

Wireless networks

Opens the mobile device's Wi-Fi settings menu. This is where you can turn on/off the Wi-Fi of the mobile device.

HARDWARE GPS - EXPANDER BOARD

The Alti-Force GPS Expander Board is an upgrade to the Alti-Force Sensor Pack, model SP30, and works only with the GoPro Hero4 camera, black and silver editions. The expander board adds GPS-based data of speed (horizontal and vertical), distance and glide ratio to video recordings.

GPS Reception

Alti-Force GPS Expander Board is a high-speed GPS receiver that requires a good quality GPS signal from at least 7 satellites to "lock on" and maintain the 3D position fix. Use of an external 50 Ohm antenna is required, an active type is best with 3.3 volt LNA gain of 25dB - 30dB. The antenna should be located as far away from the camera as possible, because the camera itself interferes with GPS signal.

GPS Expander Board Settings

All available settings for the GPS receiver are included in the Expander Board Settings section above.
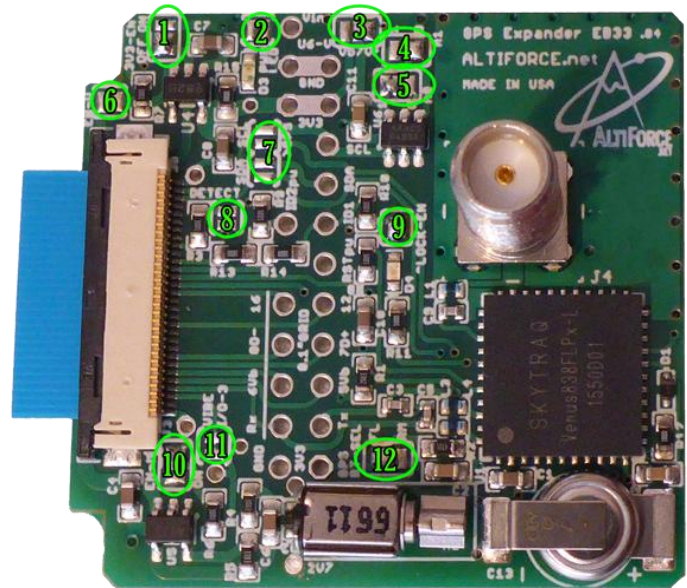
GPS Expander Board Hardware Details

Solder Jumpers: **Never solder 3 pads together!**

1. Enable for 3.3 volt regulator
    OFF: controlled through camera (default)
    ON: always on, open #6 (de-solder & cut trace)

2. Enable for 3.3v power LED indicator
    close to illuminate, open to save power (default)

3. Select supply voltage to EEPROM
    Vbattery (default) or Vregulated (do not change)

4. Select address A1 to EEPROM
    0 (default) or 1 (do not change)

5. Select address A0 to EEPROM
    0 or 1 (default) (do not change)

6. Enable for regulator control by camera
    close to enable (default with trace)

7. Enable I2C to Venus838
    open (default) (do not change)

8. Enable pull-down resistor on pin 22 (ID4)

9. Enable for GPS lock LED indicator
    close to illuminate (default), open to save power

10. Enable for motor driver
     OFF: controlled through camera (default)
     ON: always on, Not recommended, open #11 (de-solder & cut trace)

11. Enable for motor driver control by camera
     close to enable (default with trace)

12. Select boot register of Venus838
     FL: Flash - load latest software & settings (default) (do not change)
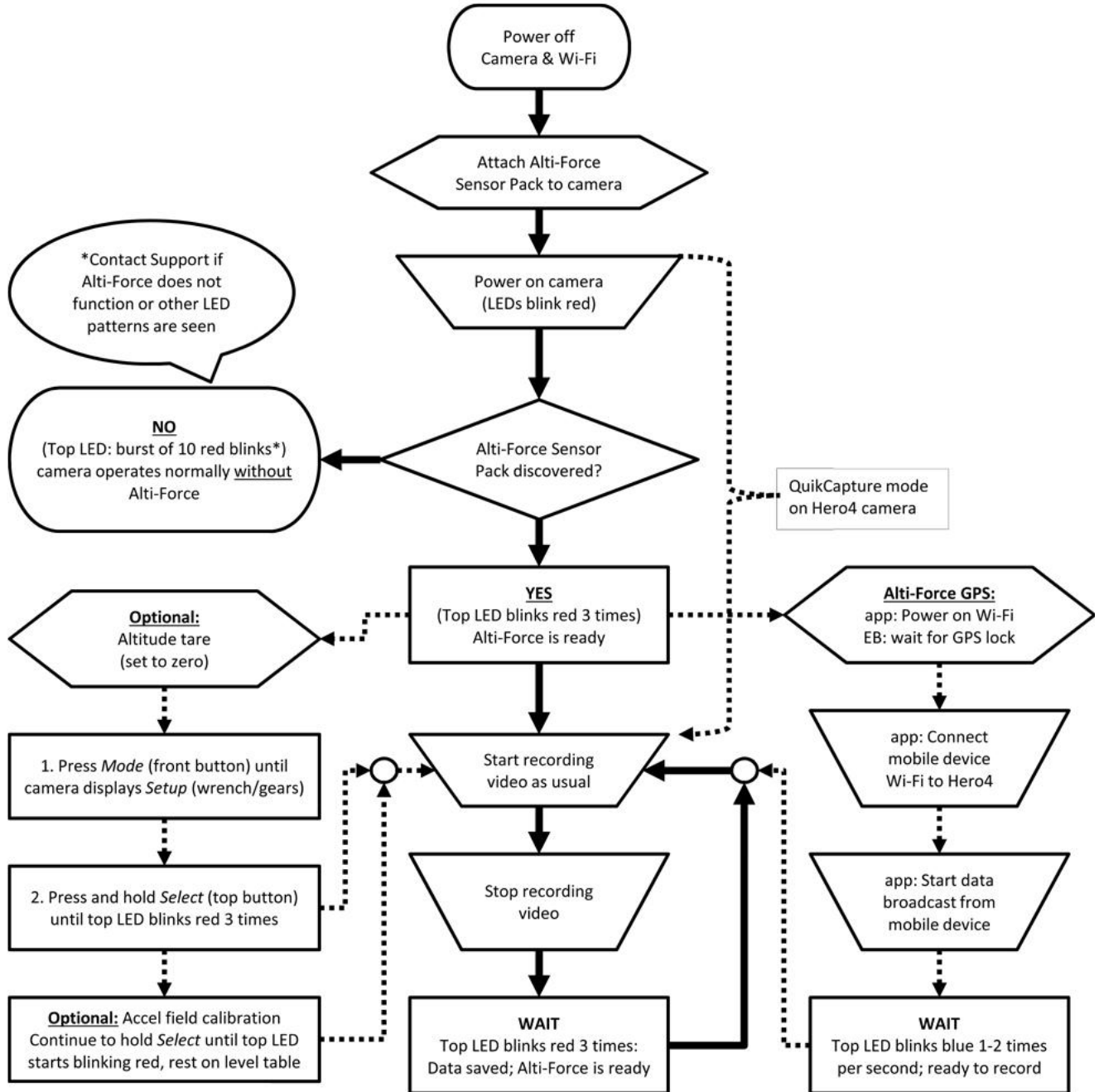   RM: ROM - load original OEM settings from SkyTraQ

GPS Antenna:

- SMA Male connector
- 50 Ohm
- Active LNA (Low Noise Amplified)
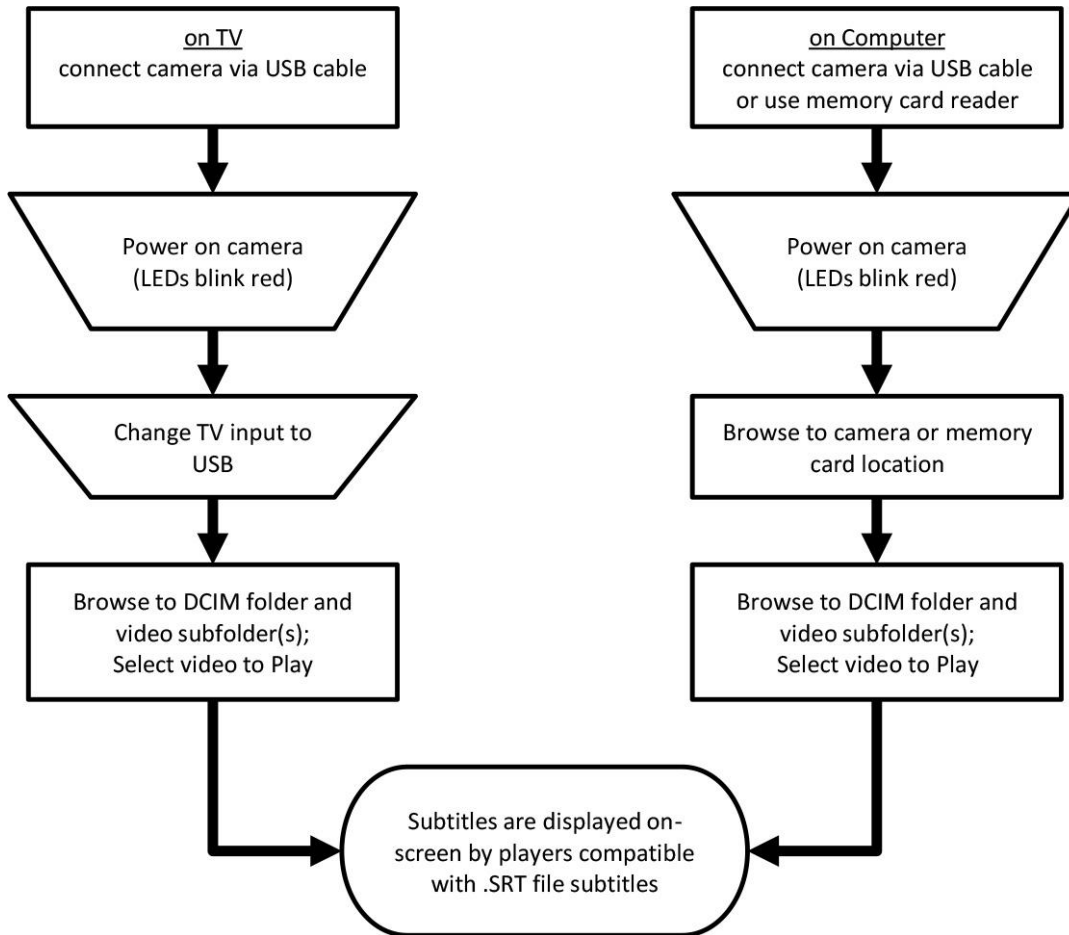- 3.3 volt
- 25dB - 29 dB gain

Operation

Video recording flowchart

Power off
Camera & Wi-Fi

Attach Alti-Force
Sensor Pack to camera

Power on camera
(LEDs blink red)

*Contact Support if Alti-Force does not function or other LED patterns are seen

NO
(Top LED: burst of 10 red blinks*)
camera operates normally <u>without</u>
Alti-Force

Alti-Force Sensor
Pack discovered?

QuikCapture mode
on Hero4 camera

Optional:
Altitude tare
(set to zero)

YES
(Top LED blinks red 3 times)
Alti-Force is ready

Alti-Force GPS:
app: Power on Wi-Fi
EB: wait for GPS lock

1. Press *Mode* (front button) until
camera displays *Setup* (wrench/gears)

Start recording
video as usual

app: Connect
mobile device
Wi-Fi to Hero4

2. Press and hold *Select* (top button)
until top LED blinks red 3 times

Stop recording
video

app: Start data
broadcast from
mobile device

Optional: Accel field calibration
Continue to hold *Select* until top LED
starts blinking red, rest on level table

WAIT
Top LED blinks red 3 times:
Data saved; Alti-Force is ready

WAIT
Top LED blinks blue 1-2 times
per second; ready to record

Video playback flowchart

Notes:
- When transferring videos from memory card, copy/move both .mp4 and .srt files together.
- Hero3 Black and Hero3+ Black require that the 4 LED camera function be enabled to detect record start.
- The sensor pack records subtitle data in video modes only (including video + photo mode).
- Time Lapse and Looping video modes are not supported.
- Photo only modes are not supported.
- Alti-Force GPS mobile app works only with Hero4 cameras using the Alti-Force Sensor Pack.
- Alti-Force is compatible with QuikCapture mode on Hero4 only with Installer version 2.11+

Accelerometer Field Calibration

The displayed value of the X-Y-Z axes should be 0-0-1 G, respectively, while the camera is **upright and on a level surface**. A "field calibration" can be performed, if necessary, to reset the axis zero points (note that this does not change scaling of the sensor). This feature requires software version 2.05+ and Alti-Force Sensor Pack models SP30 (or select SP22 models having a serial number starting with "20F").
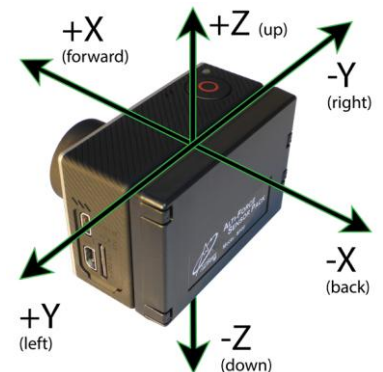
To perform the field calibration, start following the altitude zeroing procedure as follows (also described under Ground Offset). Press Mode (front button) until the camera shows the setup screen (wrench or gears), then press and hold Select (top button). Continue holding while the top LED begins to blink red (the altitude is now set to zero). With the camera **upright on a level surface**, continue to hold Select (top button) beyond altitude zeroing until the top LED begins blinking red **again**, then release the button. The camera must remain still for a few seconds so do not touch the camera until the red LED turns off.

A **successful** field calibration is indicated by the usual "Alti-Force is Ready" 3 red blinks. An **unsuccessful** field calibration is indicated by a burst of 10 red blinks, which can occur if (1) the camera is not still, (2) the camera is not in the proper upright orientation (as pictured), or (3) if using an incompatible Alti-Force Sensor Pack model.

Custom Applications

The Alti-Force Sensor Pack, model SP30, includes provisions for custom applications. A 30-pin expansion port is available for connecting an expander circuit board to the camera's Hero bus.

Breakout Board

Be cautious! All contacts are direct connections to the camera, no protection is provided against over-voltage, short circuits, misuse, etc. The standard Alti-Force software natively supports recording and displaying the input state of ID1 and ID2 as subtitles; however, other functionality will require extra software code to be generated for the custom purpose.
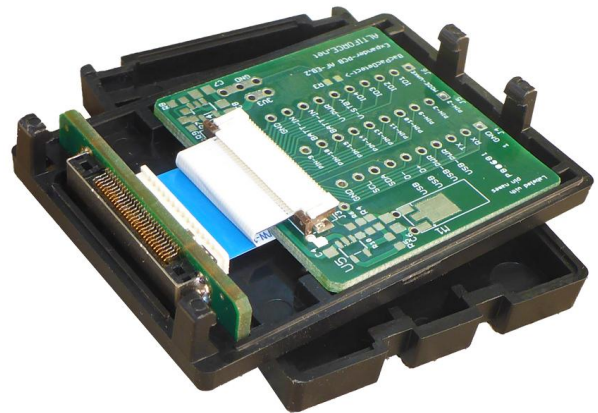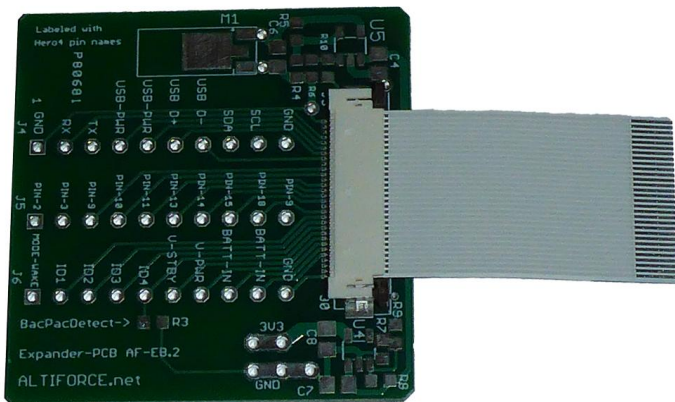
Other Applications

The Alti-Force hardware and software give a wide variety of capabilities for custom applications and projects. Alti-Force can help with your custom projects. The following list is just a few example applications:

- Additional LED indicators
- Supply voltage output to additional circuitry
- Alternative sensors
- Hard-wired USB
- Power input
- Hard-wired audio/video connections
- Relay control
- Conditional output control loop

Technical Specifications

Alti-Force Sensor Pack

Mechanical

Size (SP22):   2.36 x 1.38 x 0.40 in (60 x 35 x 10 mm)

Size (SP30):   2.32 x 1.61 x 0.40 in (59 x 41 x 10 mm)

Weight: ~1 oz (28 g)

Electrical

Voltage: 3.6v (powered from camera)

Current: <2mA typical

Sensors

Accelerometer: tri-axial, ±16 G, 0.1 resolution

Barometer: absolute pressure, 300-1100 mbar, 0.1 mbar resolution

Altitude: approx. -2000 to 30,000 feet, 1 foot resolution

Pressure conversion to Altitude assumes standard conditions

Sampling Rates

Hero3/3+:   approx. 4-6 samples per second

Hero4:   up to 25 samples per second

Subtitles: approx. 6 updates per second, maximum once per sample

Compatibility

Hero3 Black – firmware v03.00

Hero3+ Silver – firmware v03.02

Hero3+ Black – firmware v02.00 | v03.00* | v03.03*

*version requires playback via memory card reader

Hero4 Silver – firmware v05.00

Hero4 Black – firmware v05.00

Playback on most TVs and some media players, such as VLC media player, that support .SRT subtitle files

Regulatory Compliance Information

The Alti-Force Sensor Pack meets the requirements of the EC directive "Restriction of hazardous substances (RoHS)", fully defined as:

"Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment".

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.

Important Notice

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