



TELEMETRY EXTRACTOR

<https://goprotelemetryextractor.com>

Instructions manual

Telemetry Extractor can read timed data from a number of video and data formats, visualize it alongside the video footage and export it to multiple formats. It can also compute new data streams from the existing raw data.

Index

Sections

Load

GoPro, DJI drones, Insta360, GPX, DJI Action 4, INNOV (MP4/TS), Android/iPhone, Parrot, Sony (MP4), Dashcams & generic

View

Video, Map, Charts

Extract

Formats (GPX, CSV, KML, MGJSON, JSON, GeoJSON), Frequency, Options, Extract or Queue

General concepts

Native and computed streams

Smoothing

Filters

Units

Axes and native data

Options

Notifications

New project

Queue

Batch Loader

Help

Settings

Directories, Units, MapBox, Terrain altitude, Advanced, Other

System Requirements

About

Sections

You can access these sections on the top-left area of the program.

Load

The first step in your workflow will be to import video footage or a compatible data file.

You can select a single file, or multiple consecutive files that will be merged into a single one. To automate the extraction from non-consecutive files, once you are comfortable with the standard workflow consider using the Queue and Batch loading features.

The program will look for telemetry data in the selected file(s) and give you the chance to select the streams you want to import for preview and extraction. Selecting certain streams will enable additional streams that can be computed from the data. For example, acceleration data can be computed from speed data.

Once source data has been loaded, this section shows general information about the selected files and format. It will also allow you to extract static data about the imported files, like camera settings, video format, and other metadata camera manufacturers embed in the files.

In some cases, the data corresponding to a video may not be embedded into the video file, but as a separate data file with the same filename as the video but a different extension. For example, DJI drone data may be in an SRT file next to the MP4, or data from a 360 GoPro/Insta360 video may have been lost when converting the video to the equirectangular format (stitching), but the data can still be retrieved if the original video (.360 or .INSV) is placed next to it and has the same filename.

These are some of the supported cameras and formats:

GoPro

Most recent GoPro cameras include GPS and sensor data: HERO11 Black, HERO10 Black, HERO9 Black, HERO8 Black, Max, HERO7 Black, HERO6 Black, HERO5 Black, Fusion, HERO7 Silver.

Some other models have sensor data (Accelerometer, Gyroscope...) but no GPS: HERO12, HERO11 Mini, HERO10 Black Bones, HERO5 Session and HERO7 White.

The GPS data is only available when the setting is activated (look for it in the Regional Settings of the camera) and the recording is done in good signal conditions: a clear view of the sky, with no obstacles and never upside down. Turn on the camera with the Power button (not the Record one) and wait for a GPS lock before recording so the camera can find the GPS satellites.

Other streams are only available in some models and modes. For example, Orientation data is only available in the HERO8 and newer cameras (Max, HERO9...) and not in all recording modes. Also, Orientation heading values are not absolute, so applying an offset may be necessary.

The HERO4 Black & Silver, HERO5 Session & Black, HERO6 Black, and probably HERO7 models can record basic fitness data (speed, altitude, heart rate) if connected to a compatible Polar watch (V800, and maybe M600 and H10).

DJI drones

Most DJI drones record flight logs to the SD card: Air 3, Mavic 3 Pro, Mini 4, Mini 3 Pro, Mavic 3, Mini 3, FPV, Avata, Air 2s, Mavic Air 2, Mini 2, Mavic 2 Pro, Mavic 2 Zoom, Mavic 2 Enterprise, Mavic Mini, Mavic Pro, Phantom 3, Phantom 4, Phantom 4 Pro, Inspire 2, Matrice Series...

Telemetry is recorded in subtitle format, either as a separate file or embedded in the video file. Both formats are supported. Enable telemetry recording with the "Video Caption" or "Video Subtitles" option in the camera settings of the flight app.

Insta360

Most of the recent Insta360 cameras can record GPS data if paired with a compatible GPS-enabled remote: [Ace / Ace Pro](#), [One X3](#), [One RS](#), [One R](#), [One X2](#), One X, [Pro](#). Other models may also be supported. The GPS data is recorded if the setting is enabled and a compatible device is linked: the [GPS Action Remote](#), [GPS Preview Remote](#), the mobile app, one of the smartwatch apps...

If using a non-360 lens or shooting mode (4K, 1 Inch, Steadycam), note that the Insta360 app is only capable of recording the GPS data if the Pro mode (or Active HDR video) is enabled, not Basic or Quick. These modes can be changed from the camera itself (not the app) by clicking on the resolution. When using the GPS Remote, GPS data is recorded even if the Basic/Quick mode is selected. Another important limitation of the phone app is that the phone needs to have the screen on for the entire recording. Otherwise the data is not recorded correctly. For these reasons, the GPS Remote or even the smartwatch apps are recommended.

Additionally, accelerometer and gyroscope data are generally recorded when shooting in INSV format or Pro/FlowState stabilization.

Some Insta360 models record the data to the LRV file instead of the main video.

GPX

GPX files with valid tracks are supported. Most GPS trackers, GPS smart watches and Android/iOS phones can record to this format, including devices from Suunto, Wahoo, Polar, Apple and Samsung. Many software tools also allow to download data in this format, including Strava and Garmin Connect. Basic GPX files include position and time data, others also contain fitness and sensor data such as cadence, heart rate, temperature...

The GPX import option is also a good solution to import data formats that are not natively supported. Many hardware manufacturers record to their own data format but allow users to convert the data to GPX. For example, you could convert TCX files by uploading them to [Garmin Connect](#).

DJI Action 4

The [DJI Osmo Action 4 camera](#) can record GPS data when connected to the [dedicated remote control](#). Accelerometer, Orientation, and Camera settings (shutter speed, ISO...) are also recorded by the camera alone.

INNOV (MP4/TS)

INNOV creates dash cams with a focus on surveillance, mostly used on motorcycles, but also on other vehicles. GPS data is recorded via a hardware module. Basic support should work with models K2, K3 and K5, although altitude data seems to be missing on some. Other models have not been tested.

Looking for data in some INNOV models can be very slow, so the program does not necessarily do it by default. You will need to enable this in Settings.

Android/iPhone

Android and iOS (iPhone, iPad, Apple Watch) devices can record GPX files with GPS and other sensor data with the right apps if the necessary sensors are connected. For simple GPX files with GPS data, you can use:

- + [GPS Logger for Android](#): The default settings are fine (1 second interval, no filters), but enabling EGM96 is recommended
- + [GPX Trail Tracker for iOS](#): Set the app Distance filter to zero and export a GPX with TrackPoints (trk), not WayPoints

Other apps might be able to capture additional streams like heart rate, power...

Parrot

Parrot manufactures consumer and prosumer drones like the Anafi and Disco, which can record GPS data directly into the video files themselves. Other drone models might be compatible but have not been tested.

Sony (MP4)

Multiple Sony camera models, including action cams and professional camcorders, can record telemetry data. In some cases the unit has a built-in GPS module, in others you need to connect the camera to a smartphone app from their Imaging Edge lineup. Models that record some level of telemetry include at least: AS300, FDR-X3000, RXO II, ZH1. The type of data and its quality varies across models, so it is important to do some research before making a purchase decision.

Dashcams & generic

We are grouping many dashcams and generic camera brands that use other protocols under this extraction method. This includes dozens of less popular brands and models, like LabPano Pilot Era, Yada RoadCam Pro 4K, Lamax S9, Jomise T860S-GM, Vantrue S1, 70mai, Rove Stealth 4K, NextBase, Akaso, Ambarella A12, Cobra Dash Cam, BikeBro...

Also, Google's [Camera Motion Metadata Spec](#) is a standard that multiple Street View-enabled cameras use for storing GPS and sensor data.

Looking for data in some generic video formats can be very slow, so the program does not do it by default. You can enable searching specifically for data in generic cameras in Settings.

More formats will be added over time. Get in touch if you have a special interest in a particular format or sensor stream.

View

Here you can play the video and visualize the data, through a video player on the left, a map on the right, and a series of charts at the bottom. The 3 sections are synchronized, meaning that clicking or scrolling to a certain point of the video/data will update the others, making it really easy to find specific places or events in the video or data. These sections can be resized to your liking.

Video

A standard video player with typical controls: Play, pause, volume, playback speed, maximize, or show in a separate window. Most video formats are natively supported, including some 360 and 180 video projections, but in some cases the program will ask you to optimize the footage before it can be played. The footage can be rotated if necessary, and if multiple videos are present they will be selectable from the top controls.

Map

An interactive map for displaying a GPS route. The map can be controlled with the mouse and keyboard (zoom, scroll, rotate, tilt...). There are buttons to follow the current position and to fit the GPS path with the map boundaries.

The map settings enable customizing the style (Standard, satellite, hybrid... or custom maps created with MapBox), some visual settings depending on the chosen style (terrain, language, light, labels...), or the level of zoom when locked to a position. The GPX path can be of a chosen solid color or based on loaded data (for example, a gradient between blue and red based on the speed at each point of the path). There are also options to improve the data quality by smoothing or filtering it (depends on imported data source).

Charts

The imported data can be displayed as different types of charts.

- + **Vs Time**: The chosen stream (or streams) is on the vertical axis and time is on the horizontal one
- + **2 Dimensions**: You can choose a data stream for the horizontal axis and multiple streams for the vertical one. Time is conveyed by highlighting the current value
- + **Statistics**: A table with basic stats for each of the selected streams: minimum, maximum, average... both until a given point

in the timeline and for the entire project

- + **Text:** Non-numeric streams will be displayed as text

You can create multiple charts and switch between them. You can choose existing streams and a range of units for them, or compute new streams based on the existing data.

In many cases, clicking on a graph point or text value will move the video and map sections to wherever that value was recorded.

Charts have a smoothing control to reduce data noise by averaging samples over time and filters to clean up bad data samples based on available data quality measures (dilution of precision, number of satellites, etc.)

The number of chart points can be optimized for performance (in fact this is the default, as very large datasets can otherwise crash the visualization), and the visualization can be changed from lines to points.

This section also includes the Trim control, which will optionally constrain the data shown in charts, maps, and extracted files, based on timed In and Out points.

Extract

Prepare the data files you will extract by choosing the output format, wanted streams, data frequency, and a number of options.

After setting your preferences you can save them as a preset to reuse in other projects or to automate within the Batch Loader tool in the Queue

Formats (GPX, CSV, KML, MGJSON, JSON, GeoJSON)

- + GPX: GPS route files compatible with endless mapping, fitness, and data software options. Great for timed data
- + CSV: Spreadsheet format compatible with Excel, Numbers, Calc, ArcGIS, and many more
- + KML: Basic GPS route files compatible with Google Earth, Maps and more. Good for static data representations
- + MGJSON: Motion Graphics JSON for Adobe After Effects expression scripting and templates
- + JSON: Comprehensive data format based on JavaScript objects, good for complex customizations
- + GeoJSON: Open standard format designed for representing simple geographical features

Frequency

You can choose between the native frequency the data (or one of the streams) was recorded at, or a fix interval at which to record the data. If some of the exported streams were not originally recorded at that frequency, you will have a choice to interpolate new samples with different methods.

- + Auto: Linear for low frequencies and averaging for high ones
- + Linear: Finds the proportional value between raw samples
- + Latest: Displays the latest raw value
- + Nearest: Finds the nearest valid value

The data can also be exported at the video frame rate to try to match it with frames later on. In that case, interpolation is very likely to happen.

Options

- + Overwrite: Replace any existing exported files with the same path and name
- + Original path: Save the extracted data file next to the original file(s)
- + Force standard: Adapt stream names and units to match the expected format for better compatibility
- + Include time: Include a stream with the file/video time
- + Trim: Trim out the beginning and/or end of the data based on the View section bottom Trim options

Extract or Queue

The data can be extracted straight away, or queued to process a larger number of projects in on go at a later time.

General concepts

Holding your mouse over many elements in the program will open informational tooltips.

Native and computed streams

The program can show both native data streams (value types) present in the source files and new computed streams based on the existing data. For example, acceleration data can be derived from speed data, or speed from GPS coordinates and time. The accuracy of these streams will depend on the accuracy of the original data: it will be equal or less than that. Some computed streams require multiple original streams (for example latitude and longitude to compute accumulated distance), and some have

additional controls to fine-tune the computation step: for example, you may be asked to determine the minimum distance between samples to compute values like slope (grade) or bearing direction.

These are most of the available stream types, both native and computed. Their availability depends on the imported source files.

Latitude, Longitude, Altitude, Speed, Bearing, Unix Time, Pitch angle, Roll angle, Heading, Accelerometer X, Accelerometer Y, Accelerometer Z, Camera ISO, Shutter Speed, White Balance, F-number, Zoom, Exposure value, Battery %, Accumulated distance, Temperature, Heart Rate, Cadence, Power, Gyroscope X, Gyroscope Y, Gyroscope Z, Velocity North, Velocity East, Vertical Velocity, Satellites, Fix Type, Dilution of Precision, Orientation Quaternion w, Orientation Quaternion x, Orientation Quaternion y, Orientation Quaternion z, Gravity Vector X, Gravity Vector Y, Gravity Vector Z, Slope or grade, Accelerometer sum, Acceleration.

In some cases, the program can also import unknown data types, for example, numbers without units or text-based streams.

Smoothing

Charts, maps, and exports allow you to apply a smoothing amount to the data. This averages samples over time to mitigate small data inaccuracies. The specified value means the time window for averaging samples. The best place to understand what this does is probably the Vs Time Charts. Overdoing smoothing will erase meaningful data, so it is important to use it carefully.

Filters

Data streams in Charts, maps, and exports can be filtered to rule out bad data samples. Filters have a toggle button so you can easily compare the result with or without them. Available controls depend on the data source:

- + Satellites: Number of GPS satellites present. More is better, but stricter
- + Dilution of Precision: Potential errors in GPS data. Less is better, but stricter
- + Fix type: Type of GPS lock: With 2D coordinates are valid, with 3D altitude is valid too
- + Wrong speed m/s: Remove coordinates that imply impossibly high speeds. Leave a generous margin above the activity's maximum expected speed

Units

The program can understand the units of multiple data types. When that is the case, charts and exports will have an option to convert the data to other known units. In other cases, the user will need to understand the units they are exporting and optionally convert them in third-party software after extraction.

Axes and native data

The program tries to export the data close to its native state. This means the naming of axes in orientation gauges (pitch, roll, yaw, x, y, z...) will be determined mostly by the device manufacturer and might not match the user expectations. The same applies to other data types. It is recommended to review the meaning of the exported data with test files before using it in mission-critical projects.

Options

You can access these options on the top-right area of the program.

Notifications

Warnings, recommendations, and update notifications will appear here.

New project

Discard everything and start from scratch. Extract any pending file or save a Preset if you want to reuse your existing work later

Queue

Handle projects that are ready for extraction. Exports can be reordered and hovering on them displays additional information.

Batch Loader

Select multiple source files (consecutive or not) to process them faster, based on one of the saved extraction Presets. The program will try to guess which files are consecutive and should be extracted to a single file, but you can change this decision manually.

Help

Settings

Configure some defaults and preferences.

Directories

- + Extract — Where your extracted files will be saved by default
- + Cache — Where optimized media and temporary files will be saved. Choose a local folder path (not a cloud or remote one) without special characters (latin alphabet) for best results. It is recommended to use the "Delete cache" button from time to time, especially after finishing a large project where the video had to be optimized

Units

Setting preferences here will make new gauges choose units accordingly, when possible. You can choose between metric (meters, kilometers...) or imperial (feet, miles...) and nautical (knots...) preference on top of it.

MapBox

The program comes with an included range of map styles:

- + Standard: Clean map similar to Google Maps. Includes some 3D shapes
- + Satellite: Real satellite photography. Similar to Google Earth
- + Hybrid: Satellite imagery with roads and place names
- + Night roads: Dark map with an emphasis on roads
- + Basic: Clean map similar to Google Maps

You can replace the default options with your own MapBox styles with custom layers, language, colors, sizes...:

- + Create a [mapbox.com](https://www.mapbox.com) account (a free one will suffice)
- + Create your own styles with [MapBox Studio](https://www.mapbox.com/studio) (GL JS setting of at least up to 3.0.0 is supported)
- + Generate two [access tokens](#): One standard (or public) and one with the STYLES:LIST scope
- + Introduce your MapBox username and access tokens in the program Settings
- + Then your own map styles will become available

Terrain altitude

Generate terrain elevation data along imported GPS paths by creating and specifying a [a Google Maps API key](#). Data will be retrieved from Google's terrain altitude database. This generally produces good results, but can have little jumps in altitude, so it is not to be trusted a 100%, especially if computing new data streams from it, like slope or vertical speed.

Be aware that Google API keys can generate costs. The range of free usage for personal purposes is normally very generous, but do check [the Google documentation](#) to make sure you don't incur in unexpected costs.

Advanced

- + Bright mode: Change the UI of the program from dark to bright
- + Sort files alphabetically: Normally, files are sorted by their metadata. If that is causing issues, rename files alphabetically and enable this option
- + Trust video time zone: Time zones in video creation times are often wrong. By default the software tries to fix this by treating dates as local, unless this option is enabled
- + Support rare cameras: Reading data from certain camera brands can be extremely slow. Only enable this if you use an INNOV camera or if you know your video contains data but the program is failing to read it
- + Insta360 & generic: fast search: Try to parse data from Insta360, INNOV, SONY, and other less common camera brands faster. This can break compatibility with some cameras
- + Show VR options: The program will try to show VR (360/180) video correctly automatically. Enable this if it fails to do so with some videos

Other

- + Debug - Use this when requested by support. You can write multiple codes separated by commas. Restart the program after changing codes.
 - + Reset license - Use this if you want to move your Telemetry Extractor license to a new computer (of the same operating system)
-

System Requirements

Minimum

- + 64 bit Operating System
- + **Windows 10** and newer or **macOS 10.15 (Catalina)** and newer or **Ubuntu 12.04, Fedora 21, Debian 8** and newer
- + 1.6GHz processor
- + 8 GB of RAM
- + 1 GB free hard drive

Recommended

- + 2.5GHz processor
- + 16GB of RAM
- + SSD hard drive

For Mac users, both Intel and Apple Silicon versions are available.

If your operating system is not supported, get in touch by email to see what can be done.

About

Created by [Juan Irache Duesca](#)

Logo design by [Francesc Cuixart](#)

For help, error reporting and suggestions contact app@prototyping.barcelona

To share your videos and discuss tips or ideas with the community, join the [Facebook group](#)

To stay up to date with new tools, products and ideas, subscribe to the [telemetry newsletter](#) or to the [YouTube channel](#)

For more telemetry tools visit goprotelemetryextractor.com

© 2024 Telemetry Overlay S.L. All Rights Reserved

<https://goprotelemetryextractor.com>