Q500log2kml user manual

FlightLog data evaluation
for Yuneec quad or hex drones
Version 4.5

Author: Helmut Elsner
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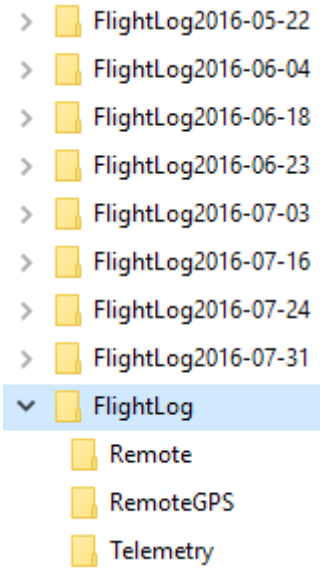
1 Introduction



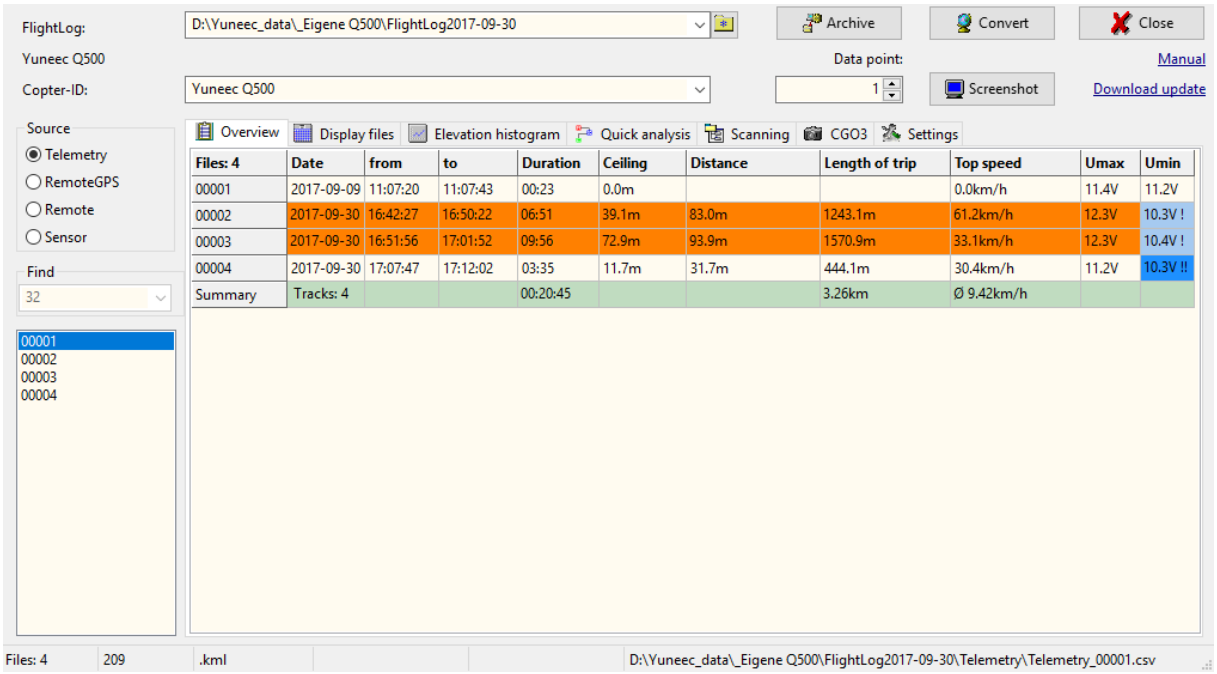
This application was made to display and analyze FlightLog data (including Telemetry) from Yuneec drones Q500, H520, H920, Typhoon H, Typhoon H Plus, Breeze, Mantis Q, but also Blade Chroma or Blade 350QX with ST10). Additionally the CSV files from Tom's flight data recorder for Hubsan can be displayed and analyzed.

The FlightLog data are available on RC-Controller or smart device used to control the aircraft. The FlightLog can be downloaded via micro USB connector.

The ST10(+) controller needs an external SD card located under the battery to save FlightLogs.

For a proper analysis the whole FlightLog directory with all sub directories needs to be copied unchanged to your PC.

Only directories will be opened by the application, not files. The only exception are sensor files from **Typhoon H Plus** which needs to be opened as single file.



In overview table, FlightLogs with error flags during the flight are marked with orange background. Those needs a deeper view. Most of those error flags are Compass Calibration Warnings. For this analysis, the application can be used as all-in-one solution.

Important note: Use this application on your own risk. There is no guaranty for correctness and/or completeness of the results of the evaluation of flight log data.

Because this all was done by own tests and private researches, the interpretation of the data may be wrong.

On the other hand, this application is freeware. Have fun...

1.1 Features (short description)

- **Archive:** Rename the FlightLog directory by using a time stamp to avoid overwriting older data. This should be the first action if you move the FlightLog data from ST10 to your PC.
- **Convert:** Convert telemetry data from drones to KML- or KMZ-files (flight path for Google Earth), GPX for other map services, for import to DashWare in order to get telemetry data in videos, as CSV file for RaceRender or as CCC waypoint file.
- **Overview:** Some important information for the flights in a table form (ceiling, max. air speed, max. distance, warnings, etc).
- **Flight record**: Scan a whole directory for telemetry files and generate a flight record.
- **Search problem cases:** Scan a whole directory with FlightLogs for predefined known problem cases (like crashes or compass warnings). This is not available for Yuneec Breeze.
- **Display files:** Browse raw data of Telemetry, Remote, RemoteGPS or Sensor files. Use this for deeper analysis. Sensor or TLOG files from PX4 controllers will be partially analyzed. There is only a basic support.
- **Search**: Search in a column of file display table. Depending on values in the columns, part of the search string or whole search string will be used to find something.
- **Elevation histogram:** Graphic elevation histogram and voltage curve. Cursor for analysis functionality.
- **Quick analysis:** Three different and select-able Histograms on the same tab sheet for quick overview and compare. Some useful profiles are available to speed-up your checks.
- **Cut files:** This function provides the possibility to cut out parts of the FlightLog and save it in a new FlightLog file set.
- **Analysis:** Analyze a predefined data area to see i.e. average speed, climb rate…
- **Control CGO3:** Test environment for commands to CGO3 via 5G WLAN connection.
- **Settings:** Three tab sheets for commission settings of the application.
- **AppLog:** Listing of actions, messages and errors from the application. For sensor files from the Typhoon H Plus, H520 or Mantis Q, text messages (MAV link "statustext") and some other data from different messages will be listed too.

1.2 Installation

No installation necessary, it is a portable application (only the binary needed). Simply unzip the downloaded file and store it to a directory where you have write access. This can also be a USB stick or a removable drive.

Download updates and user manual from my homepage.

To run the application, you might have to suppress Microsoft SmartScreen warnings: Click on "more info" and then "run anyway".

Installation auf MAC OS X:
Download and unzip archive. Start q500log2kml_EN.dmg. Open the DMG, read ReadMe file and drop both files q500log2kml into the Programs folder. Done, DMG can be closed and deleted.

Start application q500log2kml.app in program folder. If the application will not start, execute following script in terminal as administrator (Admin password is needed):

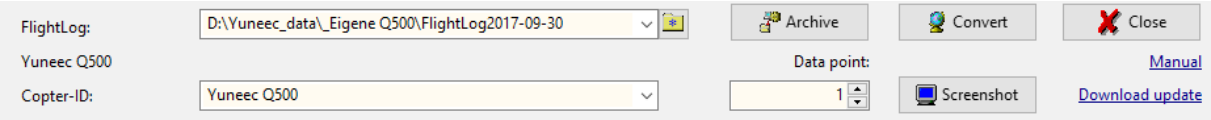
```
sudo xattr -r -d com.apple.quarantine /Applications/q500log2kml.app
```

2 Detailed description of the features

2.1 Load/Read data

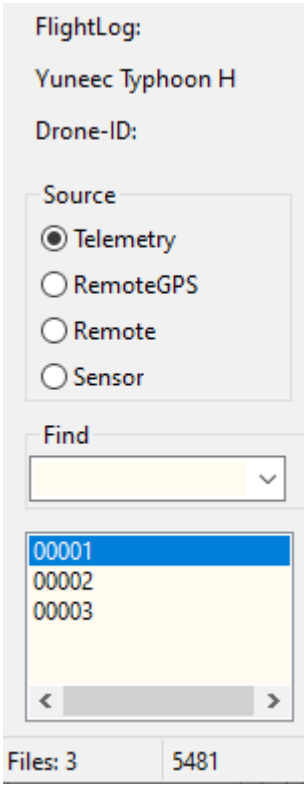
2.1.1 Main controls

In the header of the application window are the main input fields and controls.



- **FlightLog:** Select directory of FlightLog for analysis. The application saves the last six FlightLog directories that have been used in a drop-down list.
- **Drone-ID:** Free text, selectable from "Saved models" (see Settings/Other settings/Saved models), used for ID in flight paths, flight records and protocols.
- **Archive:** Renames the FlightLog directory for archiving
- **Convert:** Starts batch converting of telemetry to selected output format
- **Data point:** Indicated the selected data set
- **Screenshot:** Takes a screenshot of the application window (not available for MAC OS X)
- **Manual:** Link to this manual (either local if available as local file, otherwise to internet)
- **Download update:** Link to application download repository
- **Close:** Quits the application
- Double click on a free space in the header calls the about box.
- Double click on status bar below will copy the text part to clipboard.
- Hold mouse pointer over a data cell, value or control to get hints and more information.

On the left side of the application are following controls:



Between “FlightLog” and “Drone-ID”, the **Vehicle type** will be shown. This is unlike the Drone-ID not editable.

Source: Select the file type you want to see. The data table remains empty if the related file is not available.
Some drone types have only one log file containing telemetry and settings. Thus, source selection is not available.

Find: Input field to enter a value (text or numbers) to search for in the selected column or to filter data sets or records according search rules.

Below the “Find” section is a list field containing the **list of file numbers** that are available in the FlightLog directory. Each number will be counted as one flight although in a single file maybe more than one flight if only flight battery was changed.
Click on a file number to load the related FlightLog.
A double click reloads the whole list and jumps to the first file number.

2.1.2 Main menu

The main functions can also be called by main menu in application header. Some elements have context sensitive menu, called by right mouse button.

File
Select FlightLog directory…
Open working directory… (opens the file manager, same as double click on input field)
Select flight record directory...
Open flight record directory... (where the flight record was saved)
Open Sensor file from PX4… (to open a single PX4 TLOG or sensor file)
Convert
Archive
Close

Tools
Screenshot: Takes screenshot from the whole application window.
Not available for MAC OS X, please use CMD+Shift+4 instead)
Make flight record (only if a valid flight record directory was selected before)
Reset start/end (the next four menu items belong to FlightLog-cutting function)
Set start
Set end
Cut files
Clean telemetry Remove datasets sent via 5GHz WiFi connection (RSSI=0).
List MAVlink messages… List all types of MAVlink messages in a PX4 sensor file.

Help
Manual
Homepage (my homepage)
About Q500log2kml (same as double click on empty area of application header)

To load data to the application, **select the main directory (usually /FlightLog, /Flight2Log or /FlyLog)** where the FlightLog data are located. The FlightLog may contain sub directories (i.e. /Remote, /RemoteGPS, /Sensor and /Telemetry).

You can also Drag & Drop the directory from a file manager to the application window. Files will be checked and an overview in table form will be shown at tab sheet “Overview”. Files or directories must not be write-protected.

The numbering of sensor files for Typhoon H Plus meets not the numbers of the FlightLog. Those sensor files can only be opened and displayed as single file by menu item “Open Sensor file from PX4...”.

2.1.3 File name rules

Like sub directories the file names have to follow rules to be identified as data files:

Legacy Yuneec:
- FlightLog/Remote/Remote_*.csv
- FlightLog/RemoteGPS/RemoteGPS_*.csv
- FlightLog/Telemetry/Telemetry_*.csv

or for old ST10 without Plus only
- FlightLog/Telemetry_*.csv

Typhoon H:
- Flight2Log/Remote/Remote_*.csv
- Flight2Log/RemoteGPS/RemoteGPS_*.csv
- Flight2Log/Sensor/Sensor_*.bin
- Flight2Log/Telemetry/Telemetry_*.csv

Typhoon H Plus:
- Flight2Log/Remote/Remote_*.csv
- Flight2Log/RemoteGPS/RemoteGPS_*.csv
- Flight2Log/Sensor/Sensor_*.txt
- Flight2Log/Telemetry/Telemetry_*.csv

Breeze:
- *.log

Mantis Q:
- Sensor_*.txt
- yuneec_*.log

H520:
- *.tlog

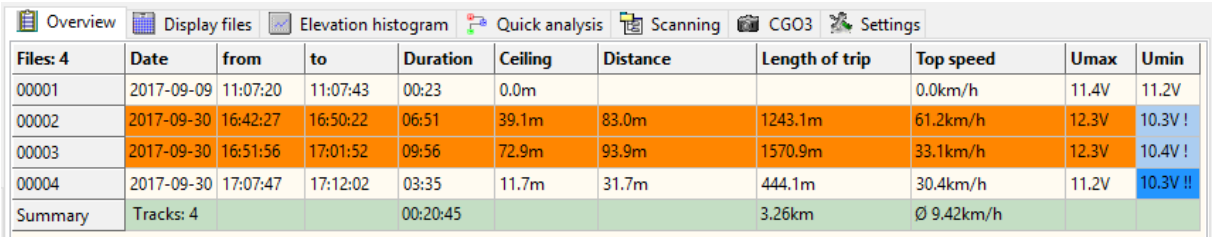
Hubsan H501 (Tom's flight data recorder for Hubsan):
- H501_*.csv

Note: '*' is wildcard for any character, mostly numbers or date/time codes.

2.2 Overview

The row ‘Total’ contains:

- Number of flights. Each telemetry file will be counted as one flight no matter if there was an additional landing in between.
- Duration of the real flight without times on the ground. Time will be added if there is valid flight mode in the telemetry data.
- Then sum of the length of all trips. This will be computed only from GPS data and may not be exact.
- The average ground speed computed from trip length and flight times.



Files: 4	Date	from	to	Duration	Ceiling	Distance	Length of trip	Top speed	Umax	Umin
00001	2017-09-09	11:07:20	11:07:43	00:23	0.0m			0.0km/h	11.4V	11.2V
00002	2017-09-30	16:42:27	16:50:22	06:51	39.1m	83.0m	1243.1m	61.2km/h	12.3V	10.3V !
00003	2017-09-30	16:51:56	17:01:52	09:56	72.9m	93.9m	1570.9m	33.1km/h	12.3V	10.4V !
00004	2017-09-30	17:07:47	17:12:02	03:35	11.7m	31.7m	444.1m	30.4km/h	11.2V	10.3V !!
Summary	Tracks: 4			00:20:45			3.26km	Ø 9.42km/h		

Flights where error flags appeared will be marked as colored line. Voltage warnings are indicated by a “!“ in the column "Umin".

Overview remains empty for H520 and Mantis Q.

To get additional information put the mouse pointer on a cell.

Keyboard shortcuts:

Ctrl + c Copy table to clipboard

The status bar at the bottom of the application window shows the following context-dependent data from left to right:

- number of files with telemetry data,
- number of data sets or selected data set in the file,
- output format for file conversion,
- state, messages or analysis results.

Usually there are for each flight three files in different sub-directories:

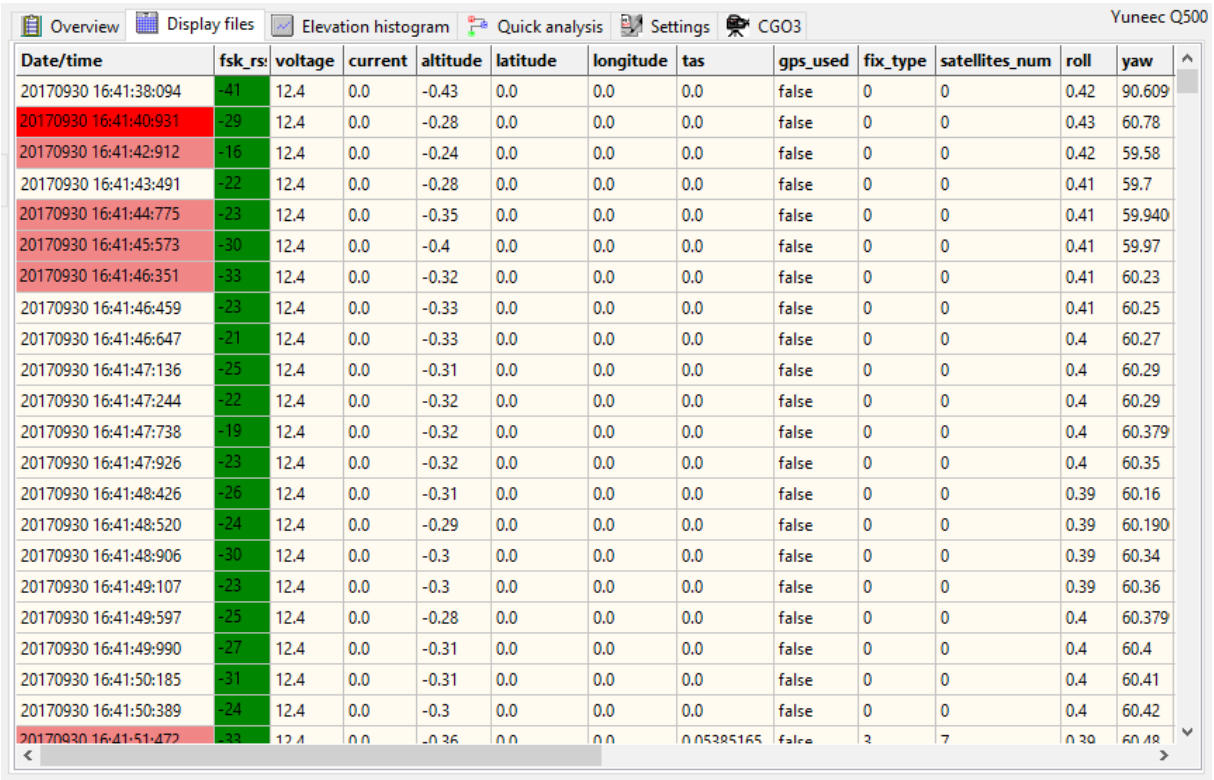
- Telemetry_*.csv in directory "\Telemetry": contains telemetry data sent by drone (selection: Copter).
- RemoteGPS_*.csv in directory "\RemoteGPS": contains GPS data from STxx ground station (Selection: RC).
- Remote_*.csv in directory "\Remote": contains the values, that are transmitted over the RC connection (selection: Radio). Stick values greater that neutral (2048) are marked with blue color, stick values smaller than neutral position are green.

Each address field and also the find criteria field contains a drop-down list with the last used values. It can be deleted by holding the CTRL key and clicking on the field.

2.3 Display files

You can see those raw data at tab sheet "Display files". Flight modes, Error flags, GPS accuracy and RC signal strength (fsk_rssi) are indicated by different colors. Maximum values for speed (tas) and altitude will be marked as yellow to find those highlights faster.

2.3.1 Telemetry, Remote, RemoteGPS



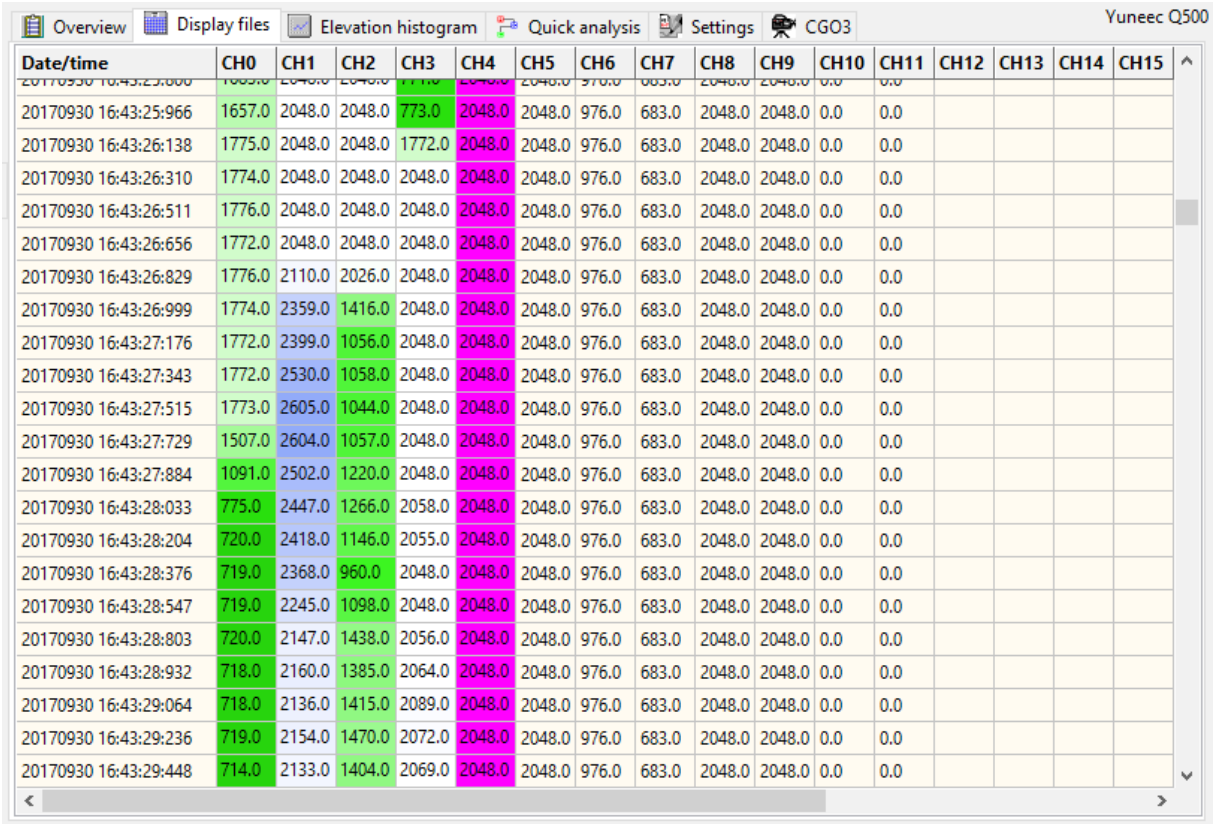
Date/time	fsk_rs	voltage	current	altitude	latitude	longitude	tas	gps_used	fix_type	satellites_num	roll	yaw
20170930 16:41:38:094	-41	12.4	0.0	-0.43	0.0	0.0	0.0	false	0	0	0.42	90.609
20170930 16:41:40:931	-29	12.4	0.0	-0.28	0.0	0.0	0.0	false	0	0	0.43	60.78
20170930 16:41:42:912	-16	12.4	0.0	-0.24	0.0	0.0	0.0	false	0	0	0.42	59.58
20170930 16:41:43:491	-22	12.4	0.0	-0.28	0.0	0.0	0.0	false	0	0	0.41	59.7
20170930 16:41:44:775	-23	12.4	0.0	-0.35	0.0	0.0	0.0	false	0	0	0.41	59.940
20170930 16:41:45:573	-30	12.4	0.0	-0.4	0.0	0.0	0.0	false	0	0	0.41	59.97
20170930 16:41:46:351	-33	12.4	0.0	-0.32	0.0	0.0	0.0	false	0	0	0.41	60.23
20170930 16:41:46:459	-23	12.4	0.0	-0.33	0.0	0.0	0.0	false	0	0	0.41	60.25
20170930 16:41:46:647	-21	12.4	0.0	-0.33	0.0	0.0	0.0	false	0	0	0.4	60.27
20170930 16:41:47:136	-25	12.4	0.0	-0.31	0.0	0.0	0.0	false	0	0	0.4	60.29
20170930 16:41:47:244	-22	12.4	0.0	-0.32	0.0	0.0	0.0	false	0	0	0.4	60.29
20170930 16:41:47:738	-19	12.4	0.0	-0.32	0.0	0.0	0.0	false	0	0	0.4	60.379
20170930 16:41:47:926	-23	12.4	0.0	-0.32	0.0	0.0	0.0	false	0	0	0.4	60.35
20170930 16:41:48:426	-26	12.4	0.0	-0.31	0.0	0.0	0.0	false	0	0	0.39	60.16
20170930 16:41:48:520	-24	12.4	0.0	-0.29	0.0	0.0	0.0	false	0	0	0.39	60.190
20170930 16:41:48:906	-30	12.4	0.0	-0.3	0.0	0.0	0.0	false	0	0	0.39	60.34
20170930 16:41:49:107	-23	12.4	0.0	-0.3	0.0	0.0	0.0	false	0	0	0.39	60.36
20170930 16:41:49:597	-25	12.4	0.0	-0.28	0.0	0.0	0.0	false	0	0	0.4	60.379
20170930 16:41:49:990	-27	12.4	0.0	-0.31	0.0	0.0	0.0	false	0	0	0.4	60.4
20170930 16:41:50:185	-31	12.4	0.0	-0.31	0.0	0.0	0.0	false	0	0	0.4	60.41
20170930 16:41:50:389	-24	12.4	0.0	-0.3	0.0	0.0	0.0	false	0	0	0.4	60.42
20170930 16:41:51:472	-33	12.4	0.0	-0.36	0.0	0.0	0.05385165	false	3	7	0.39	60.48

With "Source" (Telemetry, RemoteGPS, Remote or Sensor) you can select what file from the FlightLog shall be displayed (if file is available).

Sensor files of Typhoon H Plus (*.txt, *.tlog) are no more related to Telemetry file numbers and can only opened by main menu item "Open PX4 Sensor file...".

Also self-defined CSV files with selected PX4 sensor data (see Appendix "PX4 sensor data CSV format") can be opened and displayed in the table by main menu item "Open PX4 Sensor file...".

Example: Remote_xxxxx.csv



Date/time	CH0	CH1	CH2	CH3	CH4	CH5	CH6	CH7	CH8	CH9	CH10	CH11	CH12	CH13	CH14	CH15
20170930 16:43:25:966	1657.0	2048.0	2048.0	773.0	2048.0	2048.0	976.0	683.0	2048.0	2048.0	0.0	0.0				
20170930 16:43:26:138	1775.0	2048.0	2048.0	1772.0	2048.0	2048.0	976.0	683.0	2048.0	2048.0	0.0	0.0				
20170930 16:43:26:310	1774.0	2048.0	2048.0	2048.0	2048.0	2048.0	976.0	683.0	2048.0	2048.0	0.0	0.0				
20170930 16:43:26:511	1776.0	2048.0	2048.0	2048.0	2048.0	2048.0	976.0	683.0	2048.0	2048.0	0.0	0.0				
20170930 16:43:26:656	1772.0	2048.0	2048.0	2048.0	2048.0	2048.0	976.0	683.0	2048.0	2048.0	0.0	0.0				
20170930 16:43:26:829	1776.0	2110.0	2026.0	2048.0	2048.0	2048.0	976.0	683.0	2048.0	2048.0	0.0	0.0				
20170930 16:43:26:999	1774.0	2359.0	1416.0	2048.0	2048.0	2048.0	976.0	683.0	2048.0	2048.0	0.0	0.0				
20170930 16:43:27:176	1772.0	2399.0	1056.0	2048.0	2048.0	2048.0	976.0	683.0	2048.0	2048.0	0.0	0.0				
20170930 16:43:27:343	1772.0	2530.0	1058.0	2048.0	2048.0	2048.0	976.0	683.0	2048.0	2048.0	0.0	0.0				
20170930 16:43:27:515	1773.0	2605.0	1044.0	2048.0	2048.0	2048.0	976.0	683.0	2048.0	2048.0	0.0	0.0				
20170930 16:43:27:729	1507.0	2604.0	1057.0	2048.0	2048.0	2048.0	976.0	683.0	2048.0	2048.0	0.0	0.0				
20170930 16:43:27:884	1091.0	2502.0	1220.0	2048.0	2048.0	2048.0	976.0	683.0	2048.0	2048.0	0.0	0.0				
20170930 16:43:28:033	775.0	2447.0	1266.0	2058.0	2048.0	2048.0	976.0	683.0	2048.0	2048.0	0.0	0.0				
20170930 16:43:28:204	720.0	2418.0	1146.0	2055.0	2048.0	2048.0	976.0	683.0	2048.0	2048.0	0.0	0.0				
20170930 16:43:28:376	719.0	2368.0	960.0	2048.0	2048.0	2048.0	976.0	683.0	2048.0	2048.0	0.0	0.0				
20170930 16:43:28:547	719.0	2245.0	1098.0	2048.0	2048.0	2048.0	976.0	683.0	2048.0	2048.0	0.0	0.0				
20170930 16:43:28:803	720.0	2147.0	1438.0	2056.0	2048.0	2048.0	976.0	683.0	2048.0	2048.0	0.0	0.0				
20170930 16:43:28:932	718.0	2160.0	1385.0	2064.0	2048.0	2048.0	976.0	683.0	2048.0	2048.0	0.0	0.0				
20170930 16:43:29:064	718.0	2136.0	1415.0	2089.0	2048.0	2048.0	976.0	683.0	2048.0	2048.0	0.0	0.0				
20170930 16:43:29:236	719.0	2154.0	1470.0	2072.0	2048.0	2048.0	976.0	683.0	2048.0	2048.0	0.0	0.0				
20170930 16:43:29:448	714.0	2133.0	1404.0	2069.0	2048.0	2048.0	976.0	683.0	2048.0	2048.0	0.0	0.0				

By click on right mouse button, you will get a context menu for following functions:

- Show at Google Maps: GPS coordinates of the selected data set will be shown at Google Maps in Hybrid View.
- Show at OpenStreetMap: GPS coordinates of the selected data set will be shown at OpenStreetMap.
- Data analysis: As at Elevation histogram this performs an analysis for a predefined number of data sets, results are in status bar.
- Go to data point: Scrolls down the table to the selected data set. The selection may come from Elevation histogram if the cursor is switched on.
- Go to error flags: Scrolls down to the next error flags in the table.
- Reset start/end: Deletes saved start and end time stamps for cutting FlightLog files.
- Set start: Sets a beginning time point where cutting of files starts.
- Set end: Sets the end time point where cut out of data sets will be finished.
- Cut files: Creates a new set of FlightLog files limited by start and end point.

Double click on a cell shows additional information in the status bar below (explains flight modes, motor status and so on). The same information will appear as hint if you hold the mouse pointer on a cell.

Keyboard shortcuts:

Ctrl + c	Copy selected cells to clipboard
Ctrl + b	Set begin point to cut files or measure time intervals
Ctrl + e	Set end point to cut files or measure time intervals
Ctrl + n	Cut files and create new FlightLog limited by start and end point
Ctrl + f	Start or continue search (see chapter "Find" below)
Ctrl + s	Filter data table by search value (same functionality as "Find")
F3	Start or continue search (see chapter "Find" below)
F4	Filter data table by search value (same functionality as "Find")
F5	Reset filter, renew data table
Escape	Reset filter, renew data table

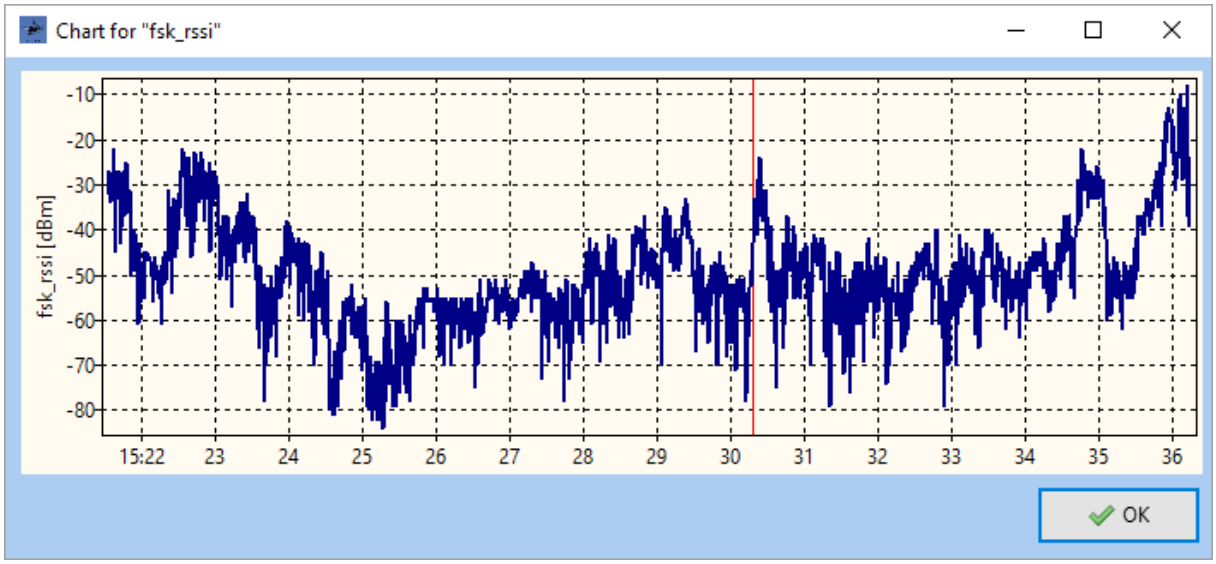
In column Date/Time cells will be marked with color, if the interval between the time stamps is bigger than expected. This may be normal, but it indicates possibly bad radio conditions or high processor load in flight controller. Good to have an eye on it...

Threshold 1: salmon - 600 ms
Threshold 2: red - 2 sec
For Yuneec Breeze and RemoteGPS the thresholds are: 1..2sec, 2..5sec

Additional detailed view:

For Telemetry, Remote or RemoteGPS, a click on the header of a column opens another window with statistics or charts. This makes it easier to identify and understand what values there are and how things go in the raw data files.

Example:

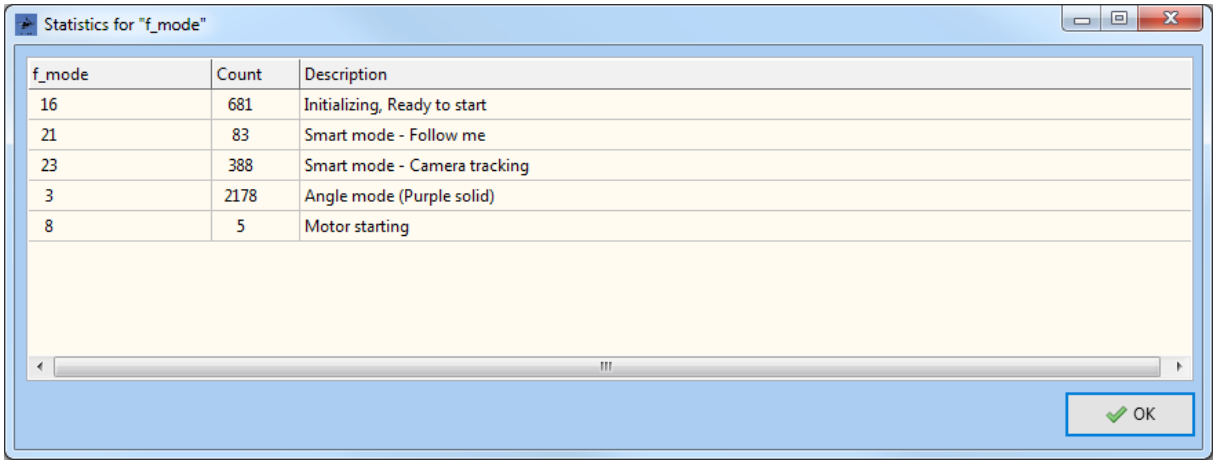


If header of columns with coordinates was clicked, then the chart shows the distance from home point.

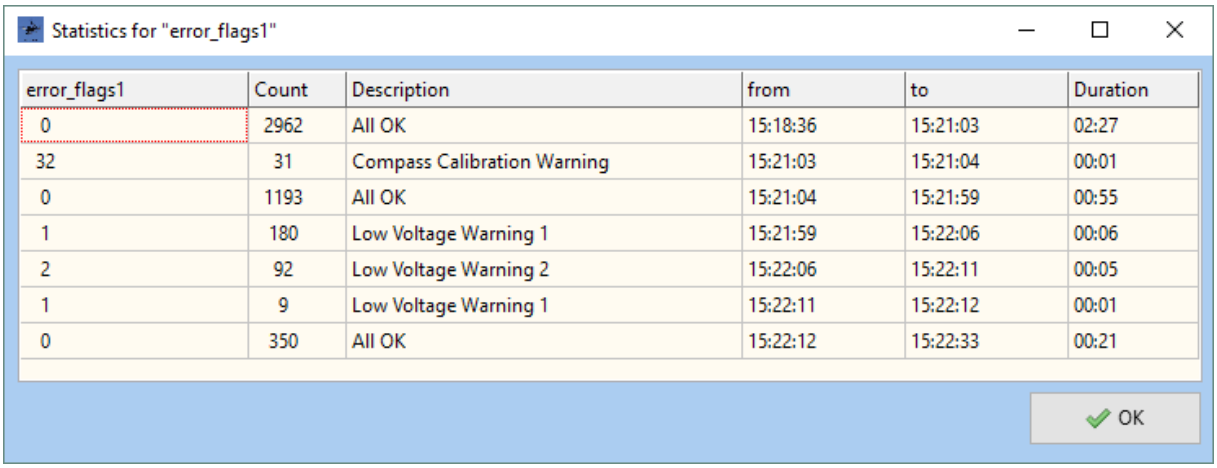
You will see a vertical red line as cursor for the cell that you have clicked in the table of raw data on the position in the timeline of the chart.

A double click on the chart will show marker when telemetry data packets were received. This was made to find communication drop outs of the RC connection.

Or, for some columns with countable values you will get simple statistics:



If it makes sense the statistics came up as detailed statistics in timely order:



A double click on a line of this detailed statistics let you jump to the related data block in the data table. For error flags, this is a faster and better way to navigate compared to context menu „Go to error flags“.

The same functionality is available for **Tom's flight data recorder for Hubsan**. It gives CSV formatted log files which records the data stream between the receiver and the MCU inside the Hubsan H901A RC controller.

Details see here (in German):
Discussion: https://www.rc-drohnen-forum.de/thread/10002
Project page: https://gitlab.com/flaretom/hubsan-flightrecorder
Manual: https://gitlab.com/flaretom/hubsan-flightrecorder/-/raw/master/Documents/Handbuch.odt

2.3.2 Sensor files

Sensor files are binary byte streams. Each data record consists of header and payload. The record header (light green) is shown as decimal number, the payload (PL1..n) is displayed as hexadecimal bytes but without 2 byte checksum (CCITT X25 CRC16).

If you hold the mouse pointer on a cell the value will be displayed as decimal and as ASCII character set.

Show Sensor data from Typhoon H:

Select sensor files as source on the left side.

SeqNc	SysID	CompID	TargetID	TgtSubID	MsgID	lenPL	PL1	PL2	PL3	PL4	PL5	PL6	PL7	PL8	PL9	PL10	PL11	PL12	PL13	PL14	PL15	PL16
00	01	01	1B	CA	CE	24	E7	05	00	00	00	00	FE	FF	C3	FF	FD	FB	00	00	FE	FF
01	01	01	1D	05	83	12	01	00	B2	13	76	44	66	66	E6	3B	2B	11				
02	01	01	AC	09	60	96	AA	C3	28	42	DD	3F	84	42	0F	83	17	40	57	E8	B0	3A
03	01	01	1E	0A	83	26	01	00	34	61	22	3D	B2	21	CE	3B	F4	7C	A0	3F	AC	F9

RecordID: **$BC**
Header length: 8 Byte
Payload length: 0 to minimum 96 bytes (the longest record I have seen up to now)

Byte no	Meaning	Values	Status
0	Record ID	$BC (= decimal: 188)	checked
1	Length Payload	0 to n	checked
2	Sequence Number	0 to 255, starts again with 0	checked
3	Target ID	undocumented/unknown	supposed
4	Target Sub ID	undocumented/unknown	supposed
5	Message ID	undocumented/unknown	supposed
6	Payload 1 (possibly Payload Data Type)	undocumented/unknown	supposed
...	Payload n	undocumented/unknown	...
n-1	CRC16 (CCITT X25)	CRC16 with Header and Payload but without Record ID	checked
n	CRC16 (CCITT X25)	CRC16 with Header and Payload but without Record ID	checked

Due to missing documentation by Yuneec, no interpretation is available for those data records.

Show sensor files from Typhoon H Plus, H520 and Mantis Q:

The concept and format of sensor data for Typhoon H Plus has changed. The file name numbers of sensor files cannot assigned to the other files in FlightLog.
Thus, sensor data only can be opened and displayed as single file by menu item "**Open Sensor file from PX4...**" in main menu.

There are big gaps in Sequence numbers, means there are messages missing (not recorded in sensor file).

Show TLOG files from H520 or sensor files from Mantis Q:

Yuneec **H520** and **Mantis Q** have only Sensor files (for H520 *.tlog) as FlyLog, but in the same format as Typhoon H Plus (all three PX4). Overview table remains empty. Only the file numbers will be displayed.

H520: *.tlog
Mantis Q: Sensor_*.txt or yuneec_*.log (there are some more log file types, but those can only opened via main menu > Filer > Open PX4 Sensor file)

All other files in the selected directory will be ignored.

All PX4 compatible files have following format:

Fix1	Fix2	SeqNc	SysID	CompID	MsgID	MsgID	MsgID	MsgName	lenPL	Fix9	Fix10	Fix11	Fix12	Fix13	Fix14	Fix15	Fix16	Fix17	Fix18	PL1	PL2	PL3
00	00	06	01	01	00	00	00	heartbeat	9	00	00	03	00	0D	0C	59	03	03	CC	96	2F	1E
00	00	40	01	01	21	00	00	global_position_int	28	FD	83	01	00	4D	8B	FD	1B	DA	4F	14	05	40
00	00	42	01	01	20	00	00	local_position_ned	28	01	84	01	00	64	5D	14	40	94	2C	1F	3F	DC
00	00	43	01	01	1E	00	00	attitude	28	05	84	01	00	14	50	25	BD	23	E0	23	BD	DB
00	00	47	01	01	F5	00	00	extended_sys_state	2	00	01	97	E6	B2	1E	02	08	64	01	00	00	
00	00	48	01	01	41	00	00	rc_channels	42	13	84	01	00	DC	05	DC	05	DC	05	DC	05	DC
00	00	4D	01	01	18	00	00	gps_raw_int	49	B2	2A	EC	05	00	00	00	00	4A	8B	FD	1B	DC

RecordID: **$FD**
Header length: 20 Byte
Payload length: 0 to minimum 156 bytes (the longest record I have seen up to now)

Byte no	Meaning	Values	Status
0	Record ID	$FD (= decimal: 253)	checked
1	length Payload	0 to n	checked
2	Fix1	always zero	
3	Fix2	always zero	
4	Sequence number	0 to 255, after 255 starts with zero again	checked
5	System ID	MAV Link System ID 1 (always 1)	checked
6	Component ID	1-Autopilot1; 100-Camera; 154-Gimbal	checked
7..9	Message ID (3 byte)	MAV link messages common	supposed
10..19	Fix9 bis Fix18	Payload (part 1)	
20	Payload 1	Payload part 2; first variable byte	
...	Payload n	Payload following variable bytes	...
n-1	CRC16 (CCITT X25)	CRC16 with Header and Payload; without Record ID; always zero	checked
n	CRC16 (CCITT X25)	CRC16 with Header and Payload; without Record ID; always zero	checked

For problem analysis following MAV Messages will be checked:

HEARTBEAT	MAV_MODE_FLAG and MAV_STATE PX4 and quadrotor will be identified as Mantis Q.
SYS_STATUS	onboard_control_sensors_present, onboard_control_sensors_enabled, onboard_control_sensors_health, SW Load, voltage und current (current zero from Mantis Q)
PARAM_VALUE_H	Onboard parameter name, type, index, counter and value
GPS_RAW_INT	Time since boot, altitude, Entfernung and coordinates as Google Maps Link
ATTITUDE	Selected data to CSV file
LOCAL_POSITION_NED	Selected data to CSV file
GLOBAL_POSITION_INT	Selected data to CSV file
RC_CHANNELS	RSSI und Channels
VFR_HUD	Climb rate to CSV file
POSITION_TARGET_GLOBAL_INT	New target position – only used for AppLog
HIGHRES_IMU	All to CSV file
ALTITUDE	Verschiedene Höhenangaben
BATTERY_STATUS	Battery voltage, current and remaining capacity
EXTENDED_SYS_STATE	MAV_LANDED_STATE
STATUSTEXT	Severity and text

The results are listed as **text in AppLog**. Additionally a CSV file can be created with all relevant data from the MAV messages. Which MAV messages will be used you can define in Settings > Data analysis. This was made for possibly needed data reduction in CSV file.

A summary of some main data will be listed:

- Begin: Coordinates as Google Maps link
- End: Coordinates as Google Maps link
- Absolute Ceiling: Height over sea level from GPS-data
- Relative Ceiling: Elevation relative to first GPS coordinate
- Distance: Maximum distance to first GPS coordinate
- Length of trip: Approximately flown route

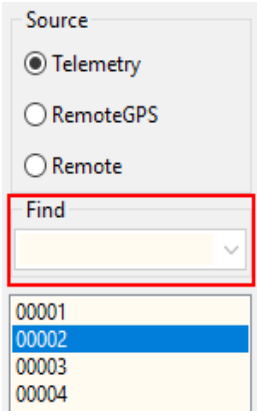
If option "**Flight path from PX4 sensor**" is set, KML/KMZ or GPX files will be created and stored in the same directory as the sensor files.
This works also for sensor files from Typhoon H Plus and *.tlog files from H520.

If GPS data are available the Elevation histogram will be filled with relative ceiling and (instead of voltage) distance to first GPS coordinate.
Voltage, current and SW-load will be shown in Quick analysis page.

If option "**Sensor data PX4 as CSV file**" is set, an additional CSV file with selected values from sensor files will be created. Format is described in Appendix "PX4 sensor data CSV format".
Those CSV files can be opened and displayed in the table by main menu item "Open PX4 Sensor file...".

For more information regarding PX4 sensor files see:
https://developer.yuneec.com/documentation/125/Supported-mavlink-messages
https://docs.px4.io/v1.9.0/en/log/flight_review.html

2.4 Find/Select



Use Find to search in whole columns of display file tables for a value. Depending on size of values the whole search string will be used or, if values are larger than 4 characters (i.e. Date/Time) or contains a dot, it is enough that a part of the value match the search string. Select the column to find in by click on a cell of the table. Search is only possible if a search string was entered and a column was selected. To search hit F3 or Ctrl+F. Find is never case sensitive.
This functionality can also be used for Scanning (see chapter “Search problem case”).

With same functionality, it is possible to select only matching data (filter the table) by F4 or Ctrl + s. F5 or change file brings you back to whole table (reset filter).

With left mouse button and Ctrl key you can take over values from the table to the search field.

2.5 Archive

The ST10 saves only 20 flights and deletes older ones. Once deleted it cannot recovered any more. That is why I pull from time to time the FlightLog data from the memory card located in the ST10 and delete the whole directory there. It will be automatically recreated during next flight by the ST10 SW. Because the directory name is then always the same, I rename it to put it into the archive on the PC. This can be done by the button Archive to avoid overwriting older files with newer ones with the same name. This function adds simply a time stamp at the end of the directory name. The format of the directory suffix depends on settings for archiving.

2.6 Convert data

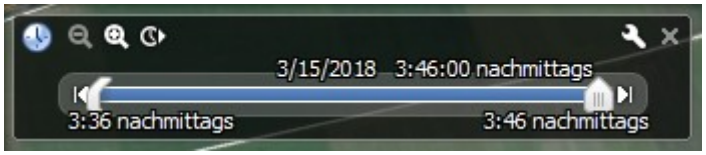
- **KML/KMZ**
  First intention of this application was to convert flight log data to KML files for Google Earth. For larger files Google recommends the format KMZ, which is nothing else than a zipped KML file. The output format can be defined in settings. KML/KMZ files can also be created from PX4 sensor files.
- **GPX**
  Another supported file format is the GPX-format (GPS Exchange Format). This file format can be used to visualize your flight in services like Doarama (now Ayvri). GPX files can also be created from PX4 sensor files.
- **dashw.csv**
  Additionally, it is now possible to create output files for DashWare (due to missing profile, this function is not available for Yuneec Breeze). The format is the same as "st2dash" from Tami: http://www.drohnen-forum.de/index.php/Thread/12303-ST2Dash-der-Flightlog-Konverter-f%C3%BCr-die-ST10-Q500/
  There you can find the related DashWare profile for the Q500 "Yuneec Q500 DashWare Profile v1.5". There will be converted only data from real flight modes. Calibration and initialization data will be suppressed. This may be then easier to synchronize it with the video.
- **rr.csv**
  There is also an experimental output format for RaceRender but without a working profile.
- **CCC Waypoints**
  You can convert telemetry to CCC waypoint files for Typhoon H.

  Remark: **Use CCC Waypoints on your own risk.**

Set the output format in "Settings" > "Data conversion". The status bar on the bottom shows the selected output format. The results are saved in the FlightLog directory. To open file manager at this directory, double click on the address field "FlightLog".

If set, also the movement of the pilot (or better of the ground station) can be added to KML/KMZ files (as black line). GPS data from RemoteGPS are used for this.

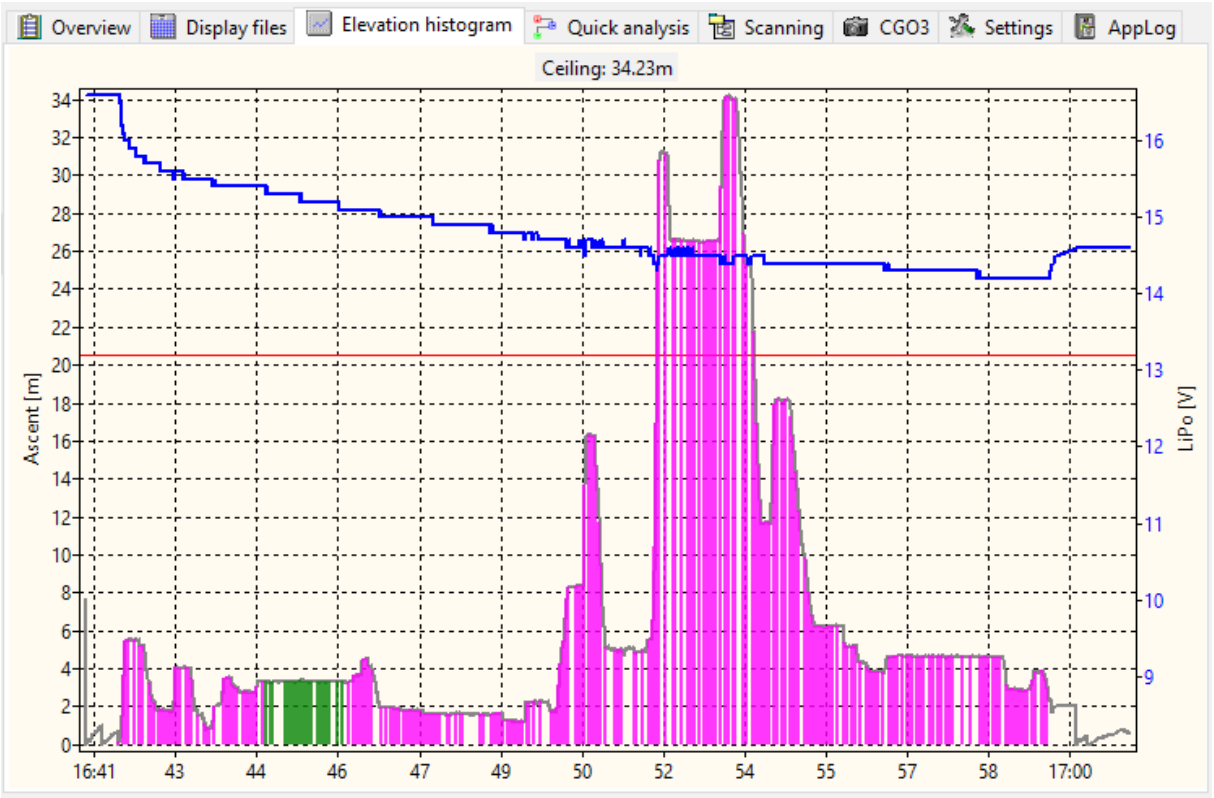
It's possible to replay KML/KMZ files by using navigation and settings of GoogleEarth:



KML/KMZ tracks contain additional placemarks at places where GPS was lost, emergency cases happened or flight modes have been changed.

2.7 Elevation histogram

This page shows the elevation histogram with different colors depending on flight mode and a curve for the battery voltage of the drone.



The elevation histogram is a bar chart with a bar for each data set, which has a color depending on the flight mode (f_mode):

- green: Smart mode (6, 21, 23),
- purple: Angle mode (3, 4),
- orange: without GPS support (2, 5, 7, 22, 24),
- blue: Stability mode (0, 1),
- red: RTH and Agility mode (13, 14, 20),
- maroon: Error, Calibrations (9, 10, 11, 12, 17, 18).
-

For Tom's flight data recorder for Hubsan the color of the bars depends on the frames that sent:

- green: all frames available (7),
- blue: no control frame but all others (3),
- maroon: all other frame combinations.

Because there are different time intervals between the telemetry data sets sent by drone, there may be gaps in the histogram between the bars.

As overlay, there is a curve for the voltage of the flight battery. The color of the curve has different meanings:

- blue: real flight with GPS support,
- red: real flight with GPS switched off,
- gray: flight by simulator UAV-Pilot (identified by values in column 'current').

Context menu, called by right mouse button:

- Copy to clipboard: Copy the picture of the elevation histogram to clipboard as bitmap.
- Save as picture...: The elevation histogram will be saved as *.png file.
- Cursor on/off: Switches on/off a vertical line following the mouse pointer as cursor to navigate in the diagram. With the cursor, you can select a data set as start for analysis.
- Go to table: Opens the table with raw data and jumps to the selected data set.
- Reset start/end: Deletes saved start and end time stamps for cutting FlightLog files.

Keyboard shortcuts:

Ctrl + c	Copy elevation histogram to clipboard
Ctrl + '+'	Increment number of data sets for analysis
Ctrl + '-'	Decrement number of data sets for analysis
Ctrl + n	Cut files and create new FlightLog limited by start and end point
Escape	Cursor off

With mouse wheel you can zoom in the histogram and shift it by hold left mouse button and move. Middle mouse button cancels the zoom function.

It's possible to replace the voltage chart by a chart for remaining capacity of the battery:
Settings > Other settings > Remaining capacity instead voltage.

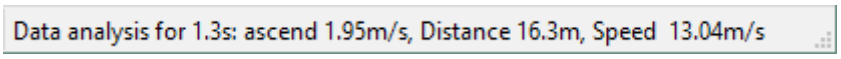
Note: The remaining battery capacity cannot exactly determined by the battery voltage. It's only an assumption. It depends on a couple of parameters like characteristics, temperature and age of the battery. To compute the remaining battery capacity I have used a table with relationship between voltage and remaining capacity that was published at RC-Groups forum here:
https://www.rcgroups.com/forums/showpost.php?p=29431951

2.8 Data analysis

The analysis functionality is available at tables in "Display files" and at "Elevation histogram". The results will be displayed in the status bar at the bottom of the application window.

Analysis at elevation histogram: Set the cursor to 'on' in context menu (activated by right mouse button) and navigate to desired data set. Start analysis by click on left mouse button. Results will be displayed in status bar at the bottom. If the CTRL-key is down when the left mouse button was clicked, then the results will be copied to clipboard too. The selected data set will be taken over to the "Data point" field in the header of the application. This is then the start of the interval of data sets defined in settings. This point can also be used as start point for analysis in table view (Display files). Following results will be shown:

- time interval depending on number of data sets for analysis defined in settings,
- average climbing or sinking rate if delta in altitude is > 2m inside the interval,
- distance between start and end point of the data interval,
- length of trip covered by data interval,
- average speed in the data interval.

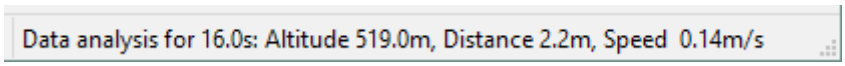


Analyse at data table: Start analysis by context menu with right mouse button. Start point is the selected data set in field "Data point". It can be set / changed by click on a cell in the table. The data interval depends on settings (the same as for analysis in elevation histogram).

Output for telemetry data (Copter) is the same as described at Analysis at elevation histogram.

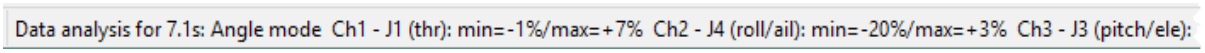
Analysis of ST10 data (GPS of the ground station) gets the following results:

- time interval depending on number of data sets for analysis defined in settings,
- average altitude over reference ellipsiod from GPS data,
- length of trip of the ground station covered by data interval,
- average speed of the ground station in the data interval.



Analysis of RC connection data (Radio) gets following results:

- time interval depending on number of data sets for analysis defined in settings,
- position of the flight mode switch,
- position/movement of the sticks – minimum, maximum position in the time interval.

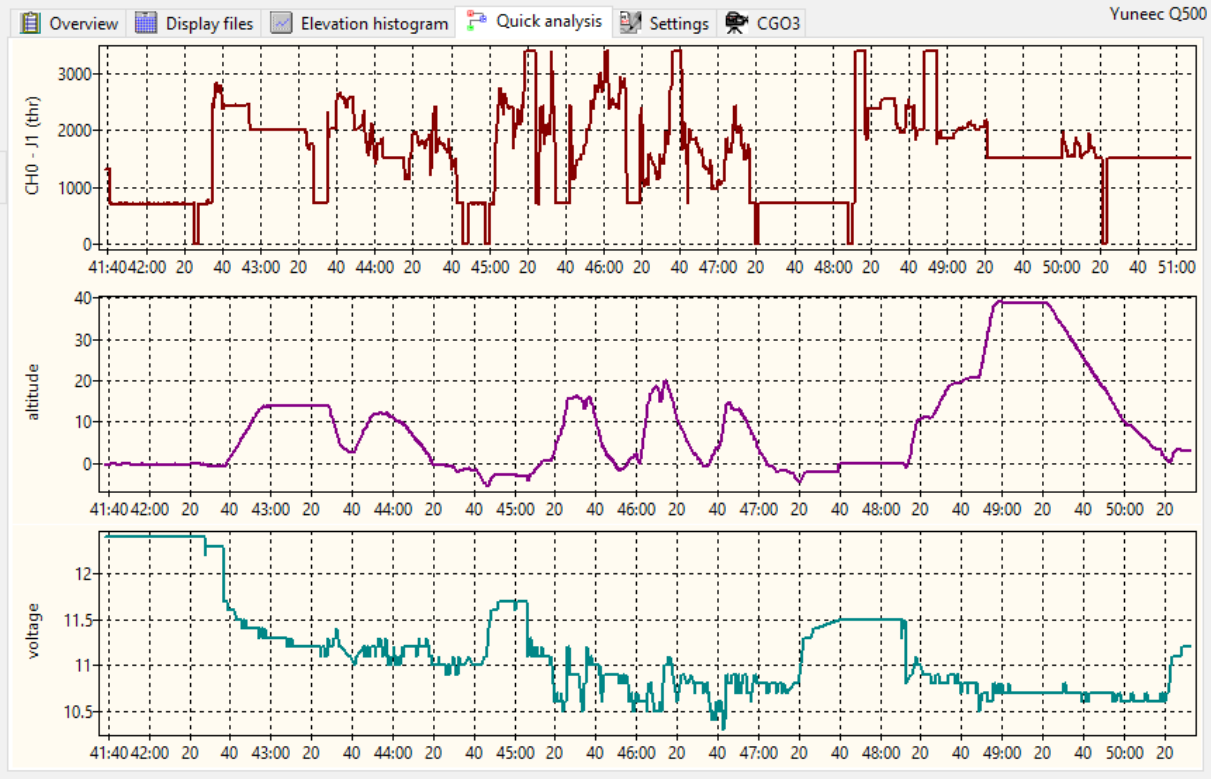


In the Elevation histogram, it‘s possible to increase the number of data sets for analysis by CTRL and + or decrease by CTRL and - key.

Also, a double click on the status-bar will copy the results of the analysis to the clipboard.

2.9 Quick analysis

To have a quick overview three freely select-able histograms will be displayed on the same tab sheet.



You can select data columns from all three files of a FlightLog (also mixed from different files like Telemetry, Remote or RemoteGPS) or use one of the predefined profiles. If mixed column selection will be used then it is a good idea to cut the files before in order to get same begin and end time stamps in all tree files.
The selection can be done on tab sheet "Settings/Data analysis" (see Settings).
Boolean values will be converted to numbers for histograms:

- true: +1
- false: -1

Among others with this function you can compare stick input with results in the telemetry (i.e. CH2 + tas + pitch). But also, all other combinations are possible, if useful or not.
Additionally, you can show a fourth histogram in another move-able window by double click on the header of the table (as described above). This is by the way the only possibility to convert and display the coordinates (longitude, latitude) into distance from start. This is not possible in Quick analysis histograms due to run-time problems.

Profiles are not available for H520 and Mantis Q. Histograms show voltage, current and SW load. This cannot be changed.

For Hubsan, there are also no profiles but you can select any column from the CSV file for the charts as it is also possible for Yuneec Breeze.

Histograms can be zoomed by mouse wheel and panned by holding left mouse button. Reset zoom and pan by middle mouse button or mouse click when Ctrl key is held down.

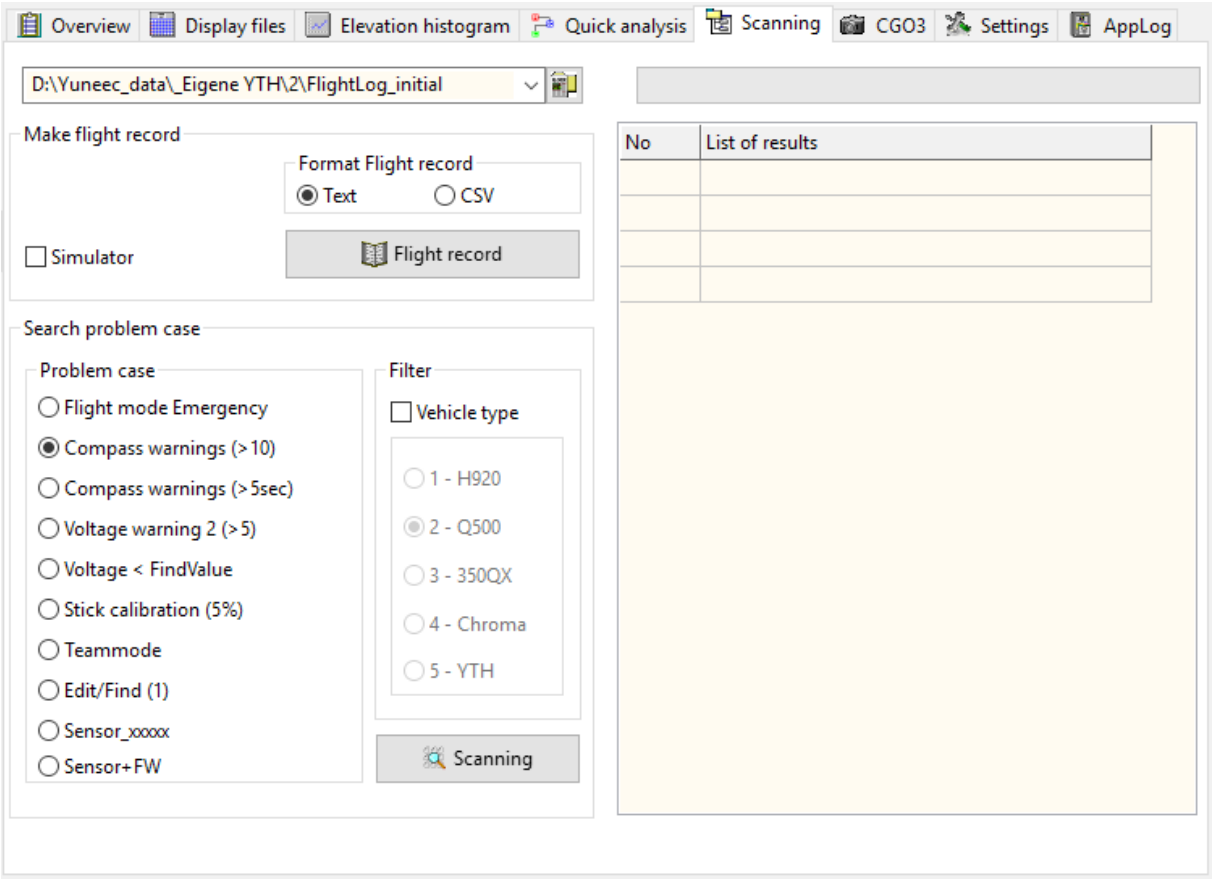
Context menu, called by right mouse button:

- Settings: Go to Settings > Data analysis to make your own assignments between freely selected data columns to the three histograms of Quick analysis.
- Default: Reset assignments to default values.
- Profiles: Available profiles are listed in a sub-menu for faster execution of frequently used data combinations.
- Show all profiles: Show all profiles as slide show (duration 3s) for fast overview.

With mouse wheel you can zoom in the histograms and shift it by hold left mouse button and move. Middle mouse button cancels the zoom function.

2.10 Scanning

Scanning means to search through a whole directory tree. This is useful for two different functions: Flight Record and Search problem cases in a large set of FlightLogs.



The selection field for the directory in use is common for both functions. As for the other directory edit fields, a double click opens this directory in the file manager. Previous used directories will be listed in the drop-down list.

Not working for Mantis Q and H520 and only partially for Typhoon H Plus (flight time incorrect).

Keyboard shortcuts:
Ctrl+c ---- Copy table of results to clipboard

2.10.1 Flight record

If you have discipline to save your own flight logs for each drone in a separate directory, you can generate a flight record file (in text or CSV format). Select the root directory for the flight logs and click on button Flight record. CSV files can be used in charts or databases.

Entries in the Copter-ID will be taken over to the header of the flight record. There is a list that will be filled from edit field “Saved models” in Settings.
The table of results shows number and overview (time or location) of the recorded flights.

Format flight record: Select output format as text or as CSV file (output in columns).

Simulator: If checked, the flight times with simulator (UAV Pilot) will be added to the total time in the flight record. (default: yes).

Not working for H520 and Mantis Q.

2.10.2 Search problem case

This function was made to find problematic cases in a large collection of FlightLogs. The selected directory will be recursive scanned for FlightLog that match predefined rules.
Following rules are available:

- **Emergency:** List FlightLogs with crashes (occurrence of flight mode 12).
- **Compass warnings:** List FlightLogs with more than ten consecutive Compass Calibration Warning flags.
- **Compass warnings (>5sec):** List FlightLogs with more five seconds consecutive Compass Calibration Warning flags. This should be alerted at the remote control unit by error message.
- **Voltage warning 2:** List FlightLogs with more than two Voltage Warnings 2.
- **Voltage:** List FlightLogs where voltage undercut the value in search field.
- **Stick calibration:** List FlightLogs where less than 5% of data sets in Remote have neutral position (2048). This may be an indicator of missing stick calibration.
- **TeamMode:** Search for Gimbal Pan Mode at control by right stick (1433.0).
- **Edit/Find:** List FlightLogs according the find/search rules described in chapter “Find/Select”. This is more flexible and aimed to find special cases.
- **Sensor_xxxxx.bin:** Find FlightLogs where Sensor file is available.
- **Sensor+FW:** Find FlightLogs where firmware issue is available in Sensor file.

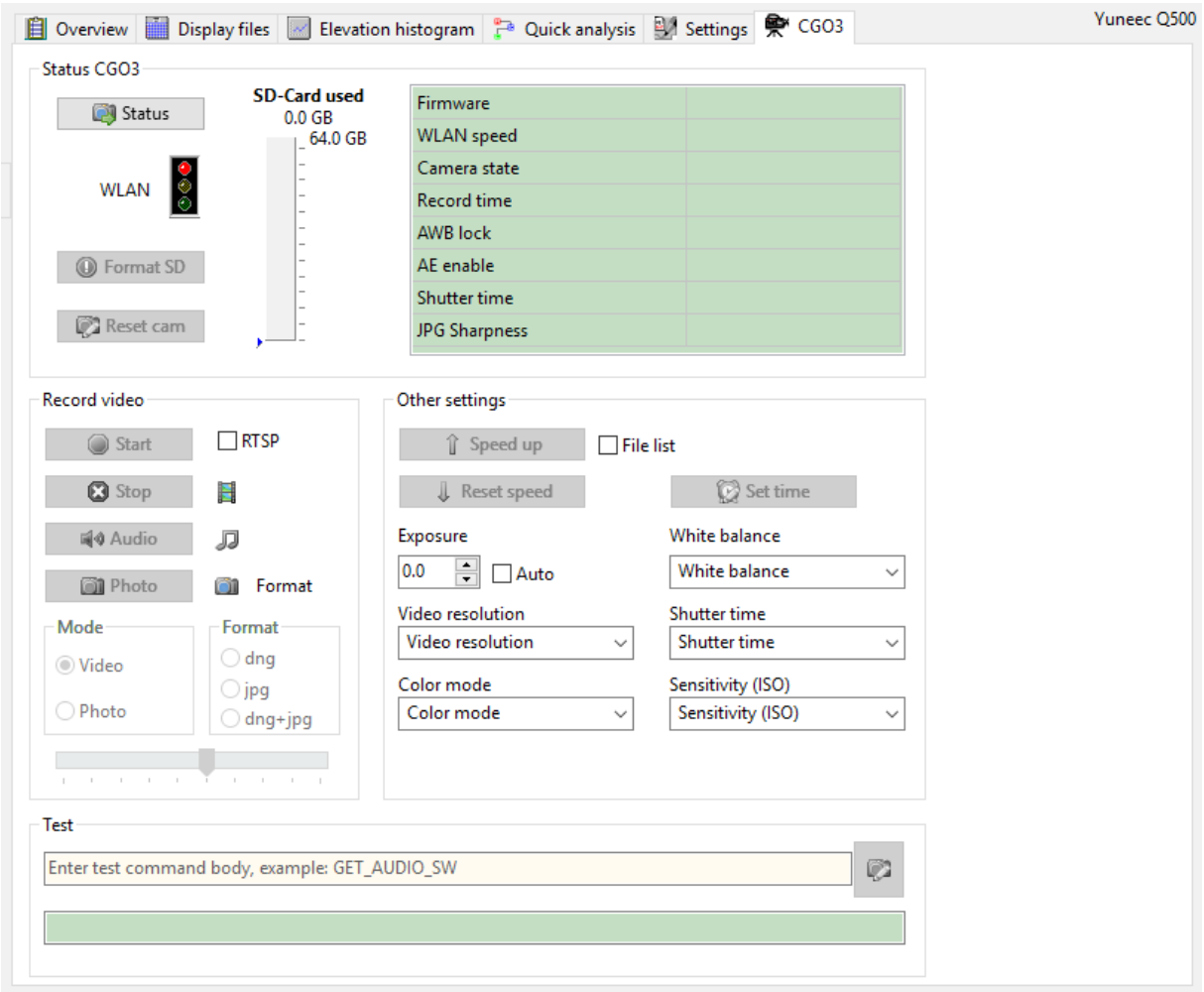
To filter the results for vehicle type the check box “Vehicle Type” must be checked.

The path to FlightLogs that match the rules will be listed in the table of results. By double click on the row the related FlightLog will be loaded and displayed.

Not useful for Hubsan, H520 and Mantis Q.

2.11 CGO3 control

This is for testing commands to CGO3 and a raw interface to control the camera. Of course, this is only possible if a WLAN connection on 5GHz is established. The default password for CGO3 WLAN is **1234567890**. To get connection, a SD card must be in the camera because the password is saved there in a file "MISC\wireless.conf". The traffic light shows the status of the WLAN connection if the Status button was clicked.



Status CGO3: Status will initialize the camera and starts a query to get status of the CGO3. Some results are in the table on the right side. Status query needs to be done first to enable the functions.

Format SD is doing a formatting of the SD card in the CGO3. It deletes all files and recreates the needed directories. Also, a new configuration file will be created with standard password for WLAN connection (1234567890).
Reset cam resets all settings of the CGO3 to factory default values.

Record video: Start / Stop controls video recording. If 'RTSP' is checked the command 'rtsp://192.168.42.1/live' will be sent to local browser. The internet browser must be able to play the RTSP stream. The protocol RSTP must be registered in the browser to make this happen (best is to redirect to VLC player).

Audio: With Audio button, you can toggle between Audio on and off.

Photo: Take a shot with Photo button.

Mode: You can switch between video and photo mode of the camera. For photo, it is recommended to switch to photo mode. Take a photo in video mode results in bad quality and only jpg.
Format: Select output format of the pictures: .dng is raw format, .jpg is compressed format. With the slider below, the sharpness for picture post processing to jpg format can be set between 1 and 10 (default is 6).

Other settings: To increase the WLAN speed to 56MBit, use Speed up. This useful if you want to download or check pictures from the CGO3. Large videos take too long to download via WLAN. If 'File list' is checked then the file system in browser will be opened, offer the possibility to browse and download files from SD card. After those action, it is recommended to set the default WLAN speed by Reset speed. This will set the WLAN speed to default 6MBit.
Set time: This will send a command to the camera to set camera internal time to current time.

If exposure is set to automatic (check box ‘Auto’ checked), then the exposure can be corrected from -2.0 to +2.0 in 0.5 steps.
If exposure is set to manual, then it is possible to select ISO sensitivity and shutter time using related drop down boxes.
You can also select video resolution from full HD, 2K up to 4K, the white balance and color mode (color mode only for jpg pictures).

Test: Test environment for commands to CGO3, CGO3+ or CGO-ET. Enter only the body of the command (i.e. 'GET_PHOTO_FORMAT'). Prefix 'http://192.168.42.1/cgi-bin/cgi?CMD=' will be automatically added. Below is the field for the return value. "rval":0 means, command checked and executed successful. By double click on this output field, the return value will be copied to the clipboard.
The description of the commands is here:
https://github.com/racerxdl/CGO/blob/master/Docs/commands.md

2.12 Settings

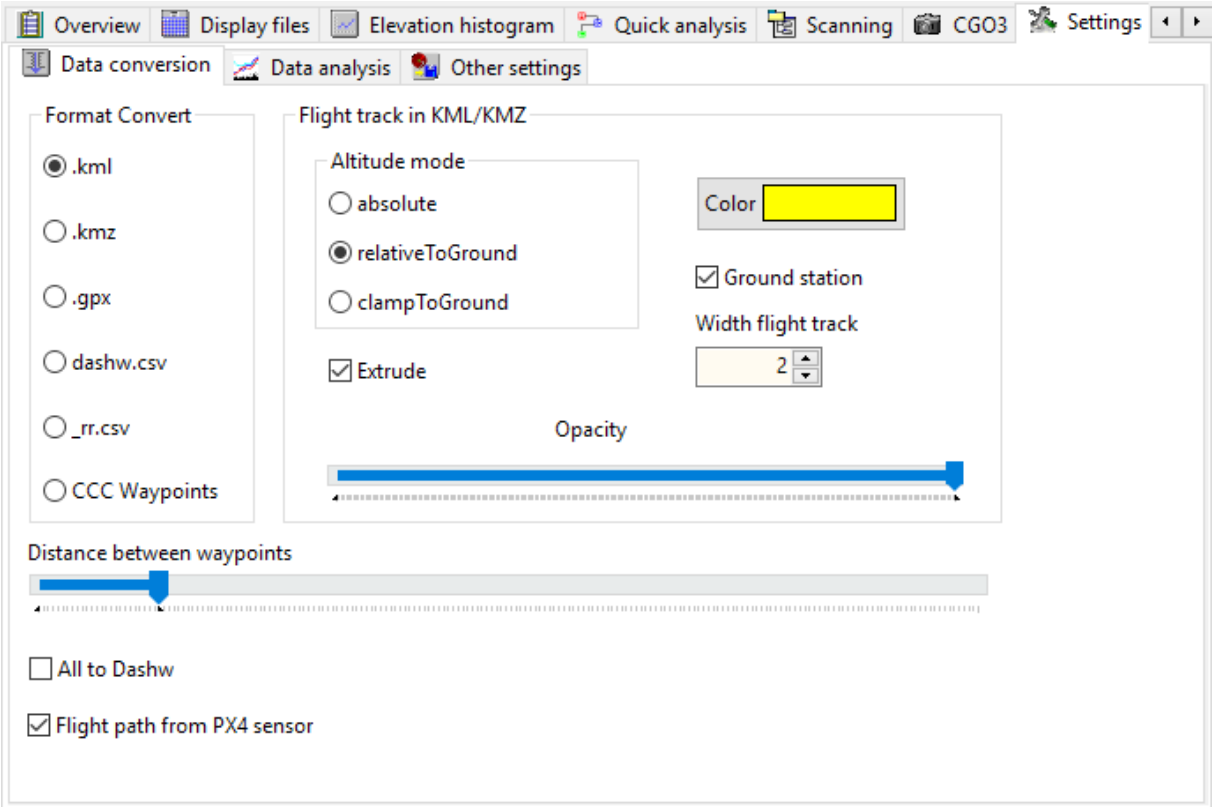
On tab sheet "Settings" it is possible to commission different parameter to define how the application works. Settings will be saved in an XML file related to the application.

Settings are separated to following tab sheets:

- Data conversions
- Data analysis
- Other settings

2.12.1 Data conversions

All settings for data conversions and like output format and how it will be displayed in GoogleEarth.



- Format - .kml ---> Convert creates for each flight a *.kml file, which can be imported to Google Earth and many other map services. The file can be read and edited by any text editor
- Format - .kmz ---> same as *.kml, but zipped.
- Format - .gpx ---> Convert creates for each flight a *.gpx file, which can be imported to many map services or applications like Doarama. The file can be read and edited by any text editor
- Format - dashw.csv ---> Convert creates *.csv files for DashWare import.
- Format - _rr.csv --> Convert creates *.csv files for RaceRender import (experimental, no profile available).
- Format - CCC waypoints ---> Convert telemetry to CCC waypoint files.

Remark: **Use CCC Waypoints on your own risk.**

Flight track in KML/KMZ - Color ---> Set colour for the flight track in Google Earth.
Flight track in KML/KMZ - Opacity ---> Set opacity for the flight track in Google Earth. Right is full opacity (=default).
Flight track in KML/KMZ - Width ---> Set width for the flight track in Google Earth (default 3).

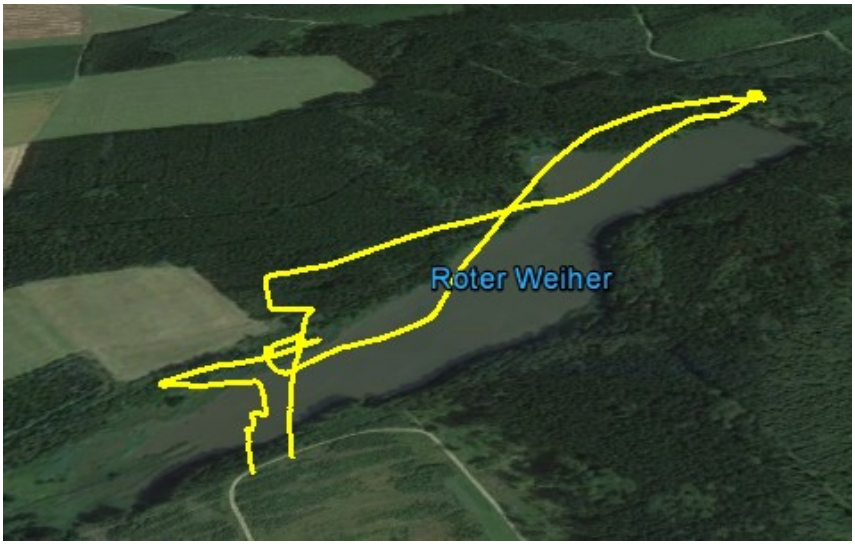
Altitude mode:

- absolute: Height above sea level computed from altitude of telemetry plus altitude from GPS-data of the STxx at start point. No distortion of the flight path, but depending on accuracy of the GPS-data of the STxx and the accuracy of the map data, the flight path may be over the ground or parts of it under the ground (invisible on map).
- relativeToGround: Only altitude from telemetry. Good for flat terrain, but distortion of flight path over hilly ground.
- clampToGround: Flight path will be projected to the ground, no height displayed. It's good to find flown-away drones.

Extrude: If checked the flight path will be drawn with vertical lines to show the elevation.

Ground station: If checked the movements of the ground station (pilot) will be added to KML/KMZ flight path.

Example (relativeToGround):



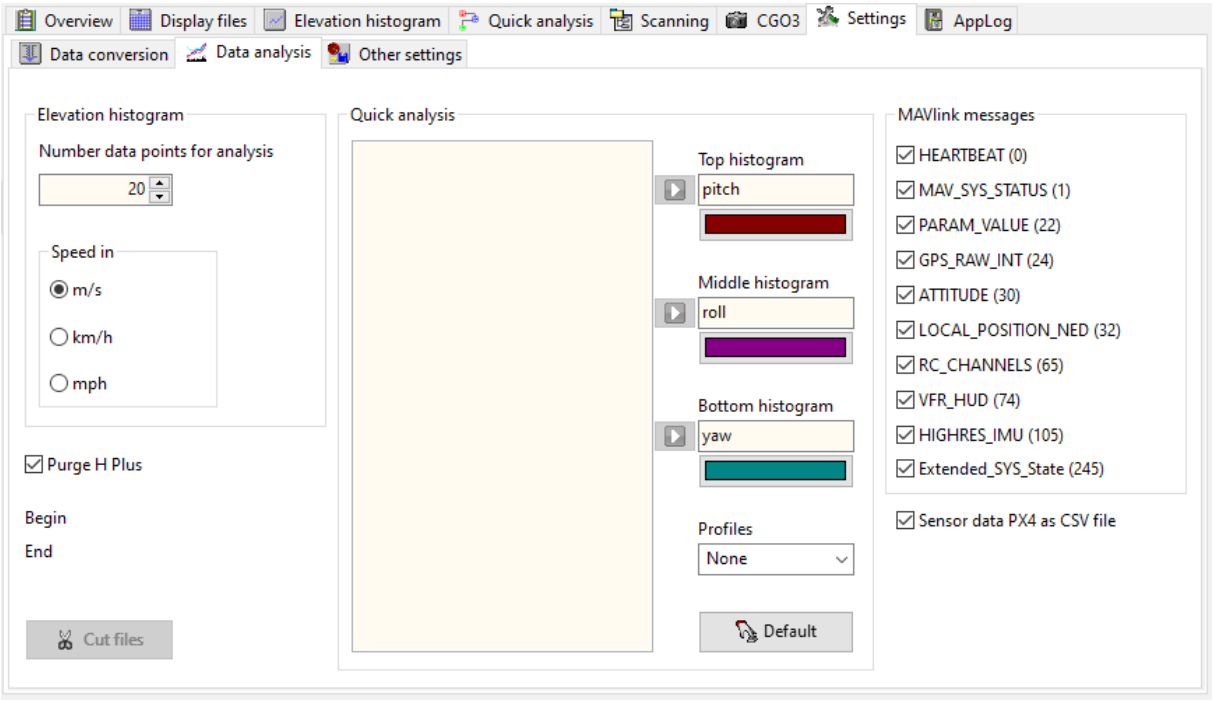
Distance between waypoints: Sets the minimal distance between two sets of coordinates of flight path, where a new CCC waypoint will be set during conversion of telemetry to CCC waypoint file.

All to Dashw**:** Export all data to DashWare (initialization, calibration, no GPS), not only from real flight modes (default: no).

Flight path from PX4 sensor**:** If checked, a KML/KMZ or GPX file depending on format settings will be created during display of PX4 sensor files. Those files will be stored in the same directory as the sensor files.
This works also for *.tlog files from H520.

2.12.2 Data analysis

Settings for data analysis in table or elevation histogram.



Elevation histogram: Settings for the analysis function by cursor (cursor on) in elevation histogram.

Number of data sets for analysis ---> set how many data sets (data interval) beginning with the selected start point will be checked.

Speed in - converts speed values in Overview and Analysis

- m/s ---> Speed (vertical and horizontal) in meter per second (default).
- km/h ---> Speed (vertical and horizontal) in kilometers per hour.
- mph ---> Speed (vertical and horizontal) in miles per hour.

If mph was selected, then also Overview and Flight record have output in mph or ft.

Purge H Plus: Typhoon H Plus sends a lot of unusable telemetry data with senseless values inside. Those will be suppressed if 'Purge H Plus' is checked (default).

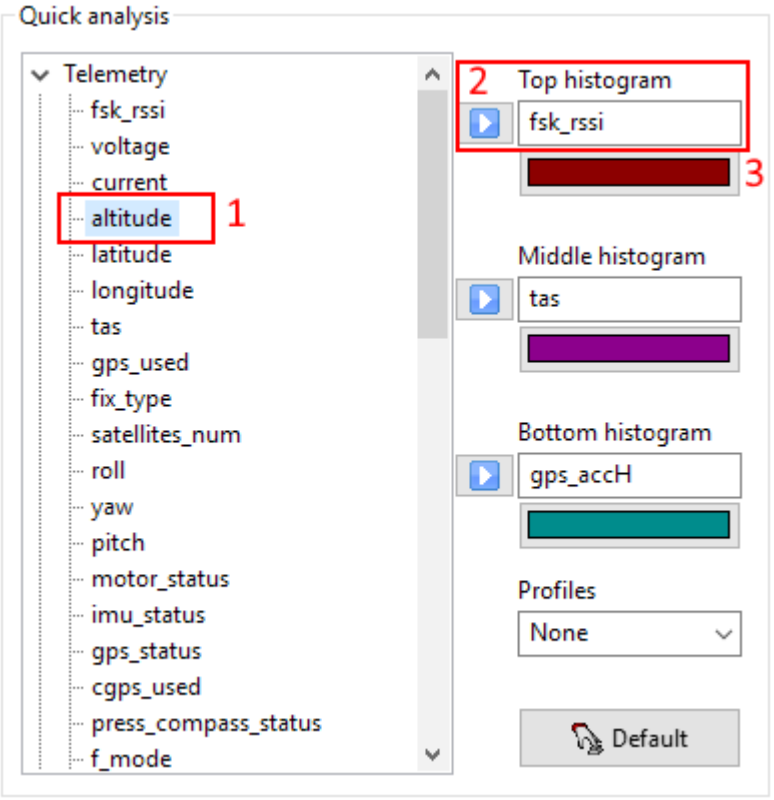
Cut files: If start and end points are set, it is possible with this function to cut data sets between start and end time points and save it to another FlightLog file set. This new FlightLog can be analyzed easier and faster if it contains only the important part of the FlightLog. With this, it is for example possible to exclude the initializing phase.
A double click on the file list on left side re-scans the FlightLog and the new FlightLog set can be selected for analysis.

Quick analysis: Select columns from the FlightLog files for display in the tree histograms at Quick analysis tab sheet and assign colors to the line series. To do this select a column name (marked as selected in blue) and assign it by blue arrow to one of the three histograms. You have to assign different columns to the three histograms but a mix from different file sets of the same FlightLog (Telemetry, RemoteGPS or Remote) is possible. The list will be created as new for each FlightLog and contains only available values from the data columns.

Example – How to set altitude as top histogram:

1. Select altitude,
2. assign to top histogram by blue arrow – done.
3. Optional: change colour of the line series.

The assignment can also be done by drag&drop.



Default: reset column assignment and colors to default values. This is useful if you change between Yuneec Breeze and other Yuneec drones.

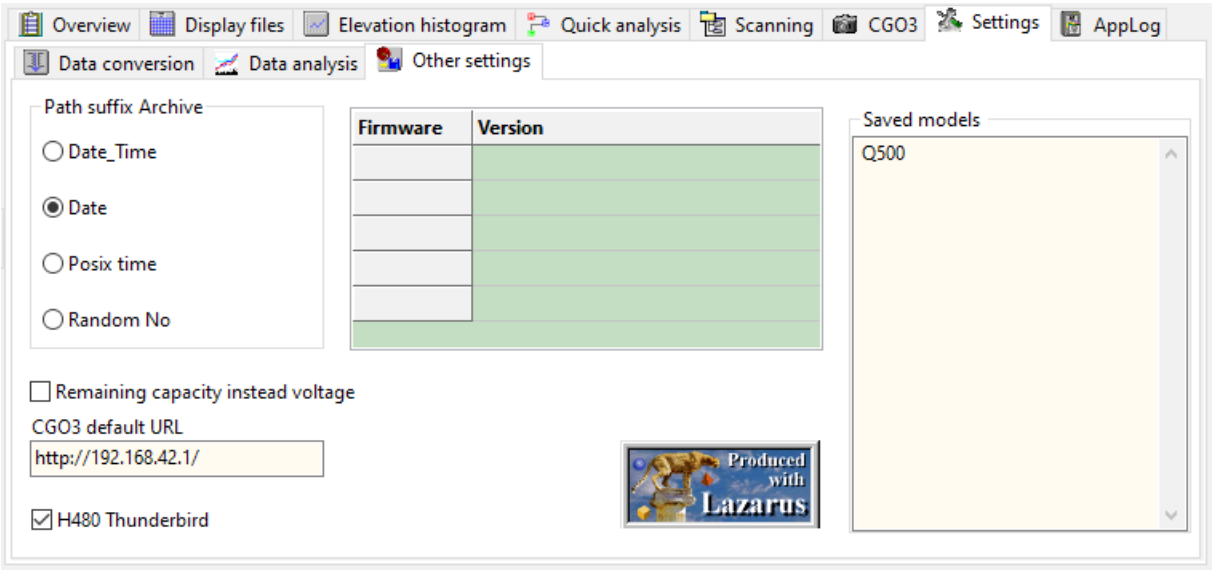
Profiles: A selection of predefined displays for quick analysis that are recently used. Profiles are not available for Yuneec Breeze or Hubsan.

MAVlink messages: Deselect MAV messages to reduce amount of data in PX4 CSV file. In doubt take all by double click (default).

Sensor data PX4 as CSV file**:** If checked, a CSV file will be created during display of PX4 sensor files containing some selected data from sensor, mainly GPS- and HW-related data. Those files will be stored in the same directory as the sensor files (Format see 'PX4 Sensor data CSV format' in Appendix).

2.12.3 Other settings

All other settings like behavior of the application.



Path suffix: Set the format how the FlightLog directory will be renamed.

- Date_Time ---> the suffix appended after "FlightLog" has the format YYYY-MM-DD_hhmmss.
- Date ---> the suffix appended after "FlightLog" has the format YYYY-MM-DD.
- POSIX time ---> the suffix appended after "FlightLog" is a POSIX time stamp (aka UNIX time – count of seconds since 1.1.1970 00:00h).

Remaining capacity instead voltage: It's possible to replace the voltage chart in Elevation Histogram by a chart of remaining capacity of the battery.

H480 Thunderbird: Force data reduction and reduced functionality for Thunderbird, a customized PX4 firmware for Typhoon H. Never use this for other types of aircrafts.

CGO3 default URL: Enter IP address of the CGO3 with trailing slash (default http://192.168.42.1/). This will be used to send commands to the camera.

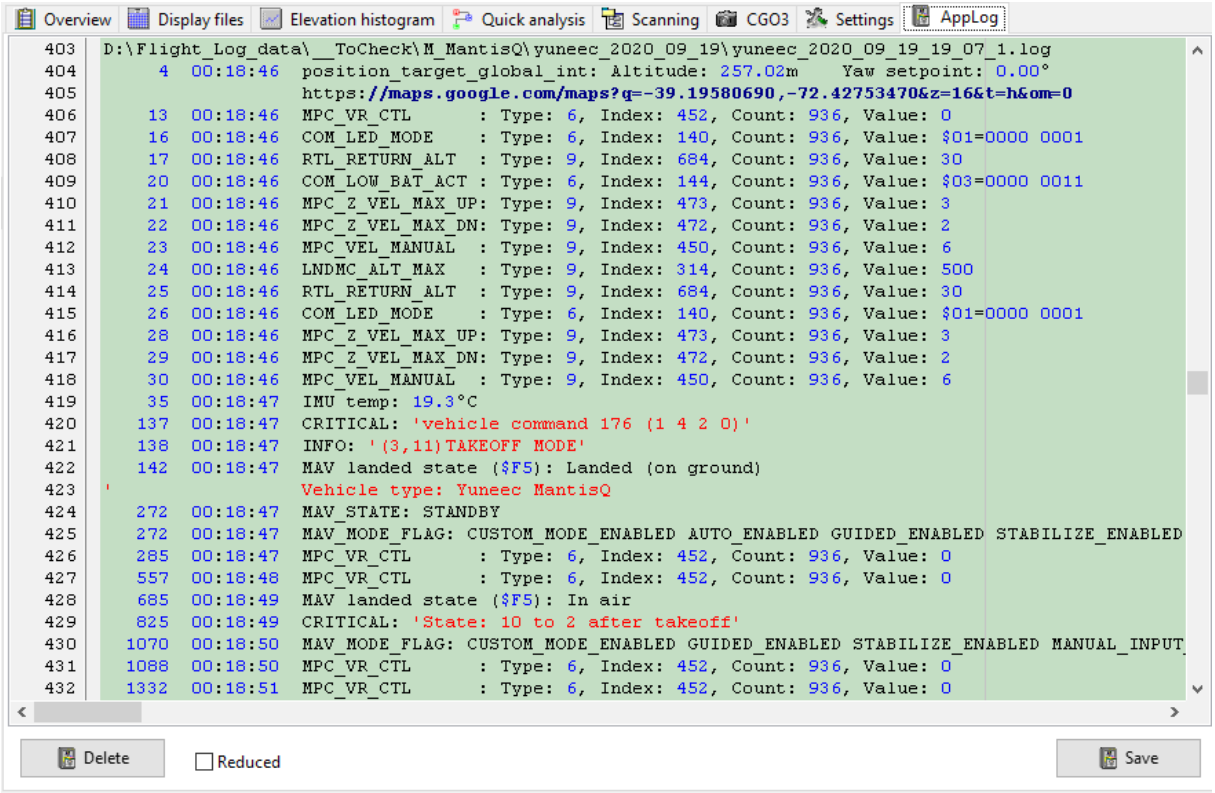
Firmware version: Shows the installed firmware versions at the drone from the Sensor files. Firmware versions are not available in all files. Only ST16 has Sensor files in a separate directory. Table remains empty for ST10.
Yuneec Breeze delivers serial number and SW-/Firmware numbers. The serial number can be taken over to “Saved models” and is then available in the list at “Copter-ID” (as well as all other entries in the “Saved models”). This can be selected and will be used as entry in header of the Flight record.

Keyboard shortcuts:
Ctrl+c ---- Copy table to clipboard

Saved models: This is a string list for different aircraft that deliver telemetry data. From this list, the related aircraft can be selected for "Copter-ID" to have the right one in the reports for documentation.

2.13 AppLog

This page contains a protocol of actions, messages and error indications. This allows to follow the action done and list messages that are already gone.



If sensor files from Typhoon H Plus, TLOG files from H520 or FlyLog files from Mantis Q were opened, those may contain text messages (MAV-Link message "statustext", MsgID=$FD). Text messages with severity will be stored in AppLog.

Also the results from some other MAV messages will be listed as text in AppLog,
A summary of some main data will be added:

- Begin: Coordinates as Google Maps link
- End: Coordinates as Google Maps link
- Absolute Ceiling: Height over sea level from GPS-data
- Relative Ceiling: Elevation relative to first GPS coordinate
- Distance: Maximum distance to first GPS coordinate
- Length of trip: Approximately flown route

Save: Save AppLog protocol to a simple text file.
In case of errors this log file should be saved and added to the error description.

Delete: Delete the whole AppLog without saving just to make it clear for new analysis actions.

Reduced: If selected only the most important information will be recorded in AppLog.

3 Appendix

3.1 Error Flags (set bit by bit)

Bit	Error Flag	Value *
7	ERROR_FLAG_AIRPORT_WARNING	128
6	ERROR_FLAG_FLYAWAY_CHECKER_WARNING	64
5	ERROR_FLAG_COMPASS_CALIBRATION_WARNING	32
4	ERROR_FLAG_TEMPERATURE_WARNING	16
3	ERROR_FLAG_COMPLETE_MOTOR_ESC_FAILURE	8
2	ERROR_FLAG_MOTOR_FAILSAFE_MODE	4
1	ERROR_FLAG_VOLTAGE_WARNING2	2
0	ERROR_FLAG_VOLTAGE_WARNING1	1

If error flag 32 is solid longer than 3 sec during flight, then a Compass error message will appear on the ST16.

* Note: If more than one error flag is set, then the sum of value is displayed in the telemetry data (Example: 33 = ERROR_FLAG_COMPASS_CALIBRATION_WARNING and ERROR_FLAG_VOLTAGE_WARNING1).

3.2 Vehicle types

Value	Vehicle Type
1	1 = Yuneec H920
2	2 = Yuneec Q500
3	3 = Blade 350QX
4	4 = Blade Chroma (380QX)
5	5 = Yuneec Typhoon H or H Plus
6	6 = Yuneec H920+ (planned but not used)

3.3 Status bytes (set bit by bit)

Bit	Dec	Hex	imu_status	press_compass_status
0	1	1	IMU	Pressure
1	2	2	n/a	
2	4	4	Compass2	Magnetometer/Compass
3	8	8	n/a	
4	16	10	Sonar	GPS
5	32	20	GPS2	RealSense
6	64	40	Controller Compass / cgps0	Sonar
7	128	80	Controller GPS / cgps1	IPS? Something only YTH has

3.4 Description Raw data (CSV files)

3.4.1 Yuneec legacy

Column header Telemetry (Copter)	Description	Unit	Status
Date / Time	Date / time including milliseconds	JJJJMMTT hh:mm:ss:zzz	checked
fsk_rssi	Received Signal Strength Indication from drone's receiver	dBm	supposed
voltage	Voltage of flight battery	V	checked
current	Current from flight battery, if sensor available (not for Q500 or Typhoon H), Remaining battery capacity in % for Typhoon H Plus	dA %	supposed for H920 checked for H Plus
altitude	Ascent relative to start point	m	checked
latitude	Latitude - GPS coordinates of drone	decimal degrees	checked
longitude	Longitude - GPS coordinates of drone	decimal degrees	checked
tas	True Air Speed, Speed of the aircraft, computed from accelerator data.	m/s	checked
gps_used	GPS usage (true, false)	boolean	checked
fix_type	GPS Fix Type	0..No GPS connected 1..No position information, GPS is connected 2..2D position 3..3D position 4..DGPS/SBAS aided 3D position 5..RTK float, 3D position 6..RTK Fixed, 3D position 7..Static fixed, typically used for base stations 8..PPP, 3D position	
satellites_num	Number of detected satellites	number	checked
roll	Roll (see Wiki Roll-Nick-Gier), postive value indicates the drone tilts to the right	°	supposed
yaw	Gier (see Wiki Roll-Nick-Gier), 0 is north, angle counts clockwise up to near 360°	°	supposed
pitch	Nick (see Wiki Roll-Nick-Gier), postive value indicates nose up, negative nose down	°	supposed
motor_status	Motor Status, bitwise. Motor numbers according the picture in the GUI	bits	supposed
imu_status	IMU Status (inertial measurement unit – see Wiki)	bits	supposed
gps_status	GPS unit status	bits	supposed
cgps_used	Controller GPS/Compass (2 highest bit from imu_status)	2 bits (0..3)	supposed
press_compass_status	Sensor status (Barometer, Magnetometer)	bits	supposed
f_mode	Code for different flight modes (see table below)	code	checked
gps_pos_used	GPS position used (true, false)	boolean	checked
vehicle_type	drone type	code	checked
error_flags1	Error flags, bitwise	bits	checked
gps_accH	Horicontal GPS accuracy. Seems to be HDOP (see Wiki - GPS HDOP)	HDOP	supposed
RemoteGPS (STxx)			
Date / Time	Date / time including milliseconds	JJJJMMTT	checked

Column header Telemetry (Copter)	Description	Unit	Status
		hh:mm:ss:zzz	
lon	Longitude - GPS coordinates of the ground station	decimal degrees	checked
lat	Latitude - GPS coordinates of the ground station	decimal degrees	checked
alt	Height from GPS relative to sea level	m	checked
accuracy	Accuracy of GPS?	Unkown, lower is better, zero means no GPS	
speed	Speed, unknown source (maybe computed from GPS coordinates), unknown unit	?	
angle	Angel of moving direction	-180° to +180°	supposed
Remote (Radio)			
Date / Time	Date / time including milliseconds	JJJJMMTT hh:mm:ss:zzz	checked
CH0 [1]	Channel 1: J1 throttle/ascent (thr)	0=Motor start/stop (B3) 2048=neutral	checked
CH1 [2]	Channel 2: J4 roll (ail)	2048=neutral	checked
CH2 [3]	Channel 3: J3 nick (ele)	2048=neutral	checked
CH3 [4]	Channel 4: J2 yaw (rud)	2048=neutral	checked
CH4 [5]	Channel 5: S4 Flight mode	3412=Smart 2048=Angle 683=RTH	checked
CH5 [6]	Channel 6: A02 - RTH	2048=neutral 4095=RTH	checked
CH6 [7]	Channel 7: K2 Camera tilt	683=horizontal (0°), 3413=vertical down (-90°)	checked
CH7 [8]	Channel 8: K1 Camera pan		checked
CH8 [9]	Channel 9: S1 Gimbal Tilt Mode	A=2184, V=3412	checked
CH9 [10]	Channel 10: S2 Gimbal Pan Mode	F=683, Team=1433, Center=1502, G=3412	checked
CH10 [11]	Channel 11: S5 Landing gear	0.0=up 4095.0, 1.0=down	checked
CH11 [12]	Channel 12: B2 Aux button	3412=off 683=Button pressed	
CH12	Channel 13: A09		
CH13	Channel 14: A10		
CH14	Channel 15: A11		
CH15	Channel 16: A12		
CH16	Channel 17: A13		
CH17	Channel 18: A14		
CH18	Channel 19: A15		
CH19	Channel 20: A16		
CH20	Channel 21: A17		
CH21	Channel 22: A18		
CH22	Channel 23: A19		
CH23	Channel 24: A20		

3.4.2 Examples channel value settings

Value	Remark	Value
0	i.e. Motor off	-150%
683	i.e. RTH stick min	-100%
1433	i.e. Panmode team (pan on right stick)	-45%
1502	i.e. Panmode 'Center'	-40%
2048	neutral	0%
2184	i.e. Tilt mode A	10%
3412	i.e. Smart mode Stick max	100%
4095	Max setting	150%

* Note: Channel assignment is only valid for stock STxx with Mode 2. For ST16 assignment can be changed by user. Also the mode of the may be changed by user, which changes assignment to throttle, yaw, roll and pitch accordingly.
CH0 in FlightLog data means Ch1 in Channel settings on ST16 (and so on for all channels).

3.4.3 Yuneec Breeze raw data

Column header FlightLog	Description	Unit	Status
UTC	Timestamp	YYYY-MM-DD hh:mm:ss	iOS: Local time Android: UTC
TimeStamp	Timestamp number	0..255 incremented	
flightMode	Flight Mode	See Breeze Flight Modes	
distance	Distance from Take Off point to center for Selfie, Orbit and Journey modes	131 - 656 (13.1ft - 65.6ft) 40 - 200 (4m - 20m)	supposed
height	Standard height	13 - 66 (1.3ft - 6.6ft) 7 - 20 (0,7m - 2m)	supposed
loseGPSAct	Fail Save Action	0 or 1	
goHomeHeight	RTH hight	98 - 2625 (9.8ft - 262.5ft) 30 - 300 (3m - 30m)	supposed
maxHeight	Geo fence Maximum Height	98 - 2625 (9.8ft - 328.1ft) 30 - 800 (3m - 80m)	supposed
maxDistance	Geo fence Maximum Distance	328 - 3281 (32.8ft - 328.1ft) 100 - 1000 (10m - 100m)	supposed
maxSpeed	Maximum Speed	328 - 1640 (3.28ft/s - 16.4ft/s) 100 - 500 (1m/s - 5m/s)	supposed
alt	Altitude	cm	supposed
IMU_Sta	IMU Status	Status bits	
lat	Coordinates, Latitude	518800483	
lon	Coordinates, Longitude	63090397	
AutoTakeOFF	Flight rule	0	
roll	Roll angle	308	
pitch	Pitch angle	344	
yaw	Yaw	-8495	
motorStatus	Motor Status	15	
errorFlags	Error Flags	0	
nsat	Number satelites, GPS fix	Signed decimal + GPS Fix Flag	supposed
voltage	LiPo remaining capacity	0..255 (255=100%)	supposed

See also the guide by *DoomMeister*:
https://drive.google.com/open?id=1QxNGsjg01hMPw7x_1W-iwRedh0BPPnLx
from https://yuneecpilots.com/threads/guide-to-analyzing-breeze-cam-flightlogs-your-data-is-needed.11652/

3.4.4 Raw data from Tom's flight data recorder for Hubsan

Flight data recorder for H501S/SS.
The project was made to record sent commands and received telemetry data between transmitter module A7105 and the main control unit of the RC controller. Transmitter and MCU communicate via SPI-Bus. Datasheet for A7105 is here: https://datasheetspdf.com/parts/A7105.pdf?id=1328531

Discussion: https://www.rc-drohnen-forum.de/thread/10002
Project page: https://gitlab.com/flaretom/hubsan-flightrecorder
Manual: https://gitlab.com/flaretom/hubsan-flightrecorder/-/raw/master/Documents/Handbuch.odt

Index	Name	Description	Unit
0	Time	Time stamp	hh:mm:ss
1	frames	Received Frames: NavData, TeleData, Control	Bitmap
2	Lat	GPS latitude	
3	Lon	GPS longitude	
4	Elev	Altitude relative	m
5	Dist	Distance	
6	Heading	Heading	°
7	Roll	Roll	°
8	Pitch	Pitch	°
9	Vbat	Voltage	V
10	Sats	Number of satellites	#
11	throttle	Throttle stick value	
12	rudder	Rudder stick value	
13	pitch	Pitch stick value	
14	yaw	Yaw stick value	
15	marker	Marker if recorder key was pressed	
16	video	Marker if video is active	
17	Photo	Marker when photo was made	
18	RSSI	Receive signal strength indicator	%
19	Velocity	Speed	m/s

Frames	Color	Descrition
0	red	No Frames received, synthetiic data set
1	orange	One Frame received: NavData
2	orange	One Frame received: TeleData
3	blue	Two Frames received: NavData, TeleData
4	orange	One Frame received: Control
5	blue	Two Frames received: NavData, Control
6	blue	Two Frames received: TeleData, Control
7	green	All Frames received: NavData, TeleData, Control

3.4.5 PX4 Sensor data CSV format

This is a self-defined format to export some of the sensor data from PX4 based Yuneec drones (Typhoon H Plus, Mantis Q, H520).

Description MAV-link format:
https://github.com/mavlink/c_library_v2/tree/master/common

Index	Name	Description	Unit	from MsgID
0	Time	Time since boot	hh:mm:ss:zzz	24, 30, 32, 65, 105
1	rssi	Receive signal strength indicator	%	65
2	Voltage	Battery voltage	V	1/147
3	Current	Battery current	A	1/147
4	Altitude	Altitude relative to ground	m	24/33/141
5	Lat	GPS latitude		24/33
6	Lon	GPS longitude		24/33
7	tas	True air speed (from xSpeed, ySpeed , zSpeed)	m/s	(32/33)
8	8	Reserved		
9	GPS fix type	GPS fix type		24
10	Num sats	Number of satellites visible	#	24
11	roll	roll	rad	30
12	yaw	yaw	rad	30
13	pitch	pitch	rad	30
14	Drop rate	Dropped packages on all links	%	1
15	Sensor health	Onboard control sensors health	Hex (bitmap)	1
16	GPS enabled	Onboard GPS sensor enabled	true/false	(1)
17	Custom mode	A bitmap for autopilot-specific flags	Hex (bitmap)	0
18	MAV state	System status flags	Hex (bitmap)	0
19	MAV mode flag	System mode bitmap	Hex (bitmap)	0
20	MAV landed state	MAV landed state from Extended_SYS_State		245
21	V_Acc	Altitude uncertainity	m	24
22	H_Acc	Postion uncertainity	m	24
23	HDOP	Horizontal dilution of position		24
24	VDOP	Vertical dilution of position		24
25	hSpeed	GPS ground speed	m/s	24
26	xAccl	X acceleration	m/s²	105
27	yAccl	Y acceleration	m/s²	105
28	zAccl	Z acceleration	m/s²	105
29	xGyro	Angular speed around X axis	rad/s	105
30	yGyro	Angular speed around Y axis	rad/s	105
31	zGyro	Angular speed around Z axis	rad/s	105
32	xMag	X magnetic field	gauss	105
33	yMag	Y magnetic field	gauss	105
34	zMag	Z magnetic field	gauss	105
35	Abs pressure	Absolute pressure	mbar	105
36	Diff pressure	Differential pressure	mbar	105
37	Pressure alt	Altitude calculated from pressure	m	105
38	xPosition	X Position	m	32
39	yPosition	Y Position	m	32
40	zPosition	Z Position	m	32
41	xSpeed	X Speed	m/s	32/33
42	ySpeed	Y Speed	m/s	32/33
43	zSpeed	Z Speed	m/s	32/33

Index	Name	Description	Unit	from MsgID
44	COG	Course over ground (not heading, but direction of movement)	degree	24
45	IMU temp	Temperature Highres_IMU	deg C	105
46	Batt remain	Remaining battery capacity	%	1/147
47	Batt used	Used capacity from main battry	mAh	(1)
48	Climb rate	Current climb rate	m/s	74
49	Throttle	Current throttle setting	%	74
50	Heading	Heading	degree	33/74
51	Altitude MSL	Altitude MSL	m	33/74/141
52	SW load	Maximum usage of the mainloop time	%	1
53	53	Reseved for further development		
54	54	Reseved for further development		
55	55	Reseved for further development		
56	56	Reseved for further development		
57	57	Onboard paramater name		22
58	58	Paramater value		22
59	MsgID	MAV message ID that sent updated values	as decimal	#
60	CH used	Total number of RC channels being received	#	65/253
61	CH1	RC channel 1 values	µs	65
62	CH2	RC channel 2 values	µs	65
63	CH3	RC channel 3 values	µs	65
64	CH4	RC channel 4 values	µs	65
65	CH5	RC channel 5 values	µs	65
66	CH6	RC channel 6 values	µs	65
67	CH7	RC channel 7 values	µs	65
68	CH8	RC channel 8 values	µs	65
69	CH9	RC channel 9 values	µs	65
70	CH10	RC channel 10 values	µs	65
71	CH11	RC channel 11 values	µs	65
72	CH12	RC channel 12 values	µs	65
73	CH13	RC channel 13 values	µs	65
74	CH14	RC channel 14 values	µs	65
75	CH15	RC channel 15 values (currently not used)	µs	65
76	CH16	RC channel 16 values (currently not used)	µs	65
77	CH17	RC channel 17 values (currently not used)	µs	65
78	CH18	RC channel 18 values (currently not used)	µs	65

The CSV will be saved in the same directory as the sensor files.

Currently following MAVlink messages will be extracted:

MAVlink Message	MsgID		
HEARTBEAT	0	$0	
SYS_STATUS	1	$1	
PARAM_VALUE_H	22	$16	
GPS_RAW_INT	24	$18	
ATTITUDE	30	$1E	
LOCAL_POSITION_NED	32	$20	
GLOBAL_POSITION_INT	33	$21	
RC_CHANNELS	65	$41	
VFR_HUD	74	$4A	
POSITION_TARGET_GLOBAL_INT	87	$57	(only for AppLog)
HIGHRES_IMU	105	$69	
ALTITUDE	141	$8D	
BATTERY_STATUS	147	$93	
EXTENDED_SYS_STATE	245	$F5	
STATUSTEXT	253	$FD	

3.5 Flight Modes

3.5.1 Flight modes Yuneec legacy and Blade Chroma

f_mode	class FModeData	Meaning	Display
0	FMODE_BLUE_SOLID	Stability mode (Blue solid)	THR
1	FMODE_BLUE_FLASHING	Blue flashing - GPS off	THR
2	FMODE_BLUE_WOULD_BE_SOLID_NO_GPS	Blue - GPS lost	THR
3	FMODE_PURPLE_SOLID	Angle mode (Purple solid)	Angle
4	FMODE_PURPLE_FLASHING	Purple flashing - GPS off	Angle
5	FMODE_PURPLE_WOULD_BE_SOLID_NO_GPS	Angle mode (Purple solid) - GPS lost	Angle
6	FMODE_SMART	Smart mode	Smart
7	FMODE_SMART_BUT_NO_GPS	Smart mode - GPS lost	Angle
8	FMODE_MOTORS_STARTING	Motor starting	Start
9	FMODE_TEMP_CALIB	Temperature calibration	Temp
10	FMODE_PRESS_CALIB	Pressure calibration	Pre Cali
11	FMODE_ACCELBIAS_CALI	Accelerator calibration	Acc Cali
12	FMODE_EMERGENCY_KILLED	Emergency/Killed	EMER
13	FMODE_GO_HOME	RTH coming	Home
14	FMODE_LANDING	RTH landing	Land
15	FMODE_BINDING	Binding	Bind
16	FMODE_READY_TO_START	Initializing, Ready to start	Ready
17	FMODE_WAITING_FOR_RC	Waiting for RC	No RC
18	FMODE_MAG_CALIB	Magnetometer calibration	Mag Cali
19	FMODE_UNKNOWN	Unknown mode	
20	FMODE_RATE	Agility mode (Rate)	Rate
21	FMODE_FOLLOW	Smart mode - Follow me	Follow
22	FMODE_FOLLOW_NO_GPS	Smart mode - Follow me - GPS lost	THR
23	FMODE_CAMERA_TRACKING	Smart mode - Camera tracking	Watch
24	FMODE_CAMERA_TRACKING_NO_GPS	Camera tracking - GPS lost	THR
26	FMODE_TASK_CCC	Task Curve Cable Cam	CCC
27	FMODE_TASK_JOUR	Task Journey	JOUR
28	FMODE_TASK_POI	Task Point of Interest	POI
29	FMODE_TASK_ORBIT	Task Orbit	ORBIT
32	FMODE_ANGLE_MODE_IPS_ONLY	Indoor Positioning System	IPS
33	?	Waypoints	WAYPOINT

3.5.2 Flight Modes Yuneec Typhoon H Plus

f_mode	Meaning	Display	Status
4	Manual mode (without GPS support)	Manual Mode	supposed
5	Angle mode	Angle Mode	supposed
6	Smart mode	Smart Mode	supposed
7	Sport mode	Sport Mode	supposed
10	unknown	?	
12	RTH coming	?	supposed
13	RTH landing	?	supposed
17	unknown, very rare, possibly a wrong data set	?	

3.5.3 Flight Modes Blade 350QX (found by try and error)

f_mode	Chroma (380QX)	Display	Blade 350QX
0	Stability mode (Blue solid)	Stab	
1	Blue flashing - GPS off	Stab	
2	Blue - GPS lost	Stab	
3	Angle mode (Purple solid)	AP	Waiting for RC
4	Purple flashing - GPS off	AP	Initializing
5	Angle mode (Purple solid) - GPS lost	AP	Motor starting
6	Smart mode	Smart	
7	Smart mode - GPS lost	AP	
8	Motor starting	Start	Emergency
9	Temperature calibration	Temp	RTH landing
10	Pressure calibration	Pre Cali	Agility - GPS off
11	Accelerator calibration	Acc Cali	Stability
12	Emergency/Killed	EMER	Smart Mode
13	RTH coming	Home	Agility Mode
14	RTH landing	Land	RTH coming
15	Binding	Bind	
16	Initializing, Ready to start	Ready	
17	Waiting for RC	No RC	Magnetometer calibration
18	Magnetometer calibration	Mag Cali	
19	Unknown mode		
20	Agility mode (Rate)	Agil	
21	Smart mode - Follow me	Follow	
22	Smart mode - Follow me - GPS lost	Follow	
23	Smart mode - Camera tracking	Track	Binding
24	Camera tracking - GPS lost	Track	
25			AP Mode

3.5.4 Flight modes H480 Thunderbird (PX4 Autopilot)

f_mode	Mode	Color in table	Color of bars in Elevation diagram
0	Stabilized	blue	blue
1	Altitude	orange	orange
3	Position	purple	purple
8	GPS acquiring	none	n/a
13	RTH	maroon	maroon
16	Ready to start	silver	n/a
20	Rattitude	red	red
33	Mission	green	green

PX4 flight modes overview: https://docs.px4.io/master/en/getting_started/flight_modes.html

3.5.5 Flight Modes Yuneec Breeze

flightMode	Breeze Flight modes	AutoTakeOFF	Breeze Flight modes
0		0	On the ground
1		1	Take off
2	Selfie	2	Flying
3	No Mode (No Task Selected)		
4	Follow Me		
5	Journey		
6	Pilot		
7	Orbit		
8	Return To Home	16	Self landing
9			
10	Pilot (No GPS)	18	Pilot landing

3.6 Thresholds / color coding

Meaning	Color	Date/time	fsk_rssk	gps_accH
Poor	Red	>2s	>85	>2,5
Reasonable	Light red	600ms-2s	70-85	1,8-2,5
Good	Light green		55-70	1-1,8
Very good	Green		<55	<1
Maximum values	Yellow			

All thresholds are self-defined and only for orientation in the raw data.

3.7 Short description – Prepare telemetry for DashWare

Step 1: Prepare DashWare (only once the first time):
- download and install latest DashWare from http://www.DashWare.net/DashWare-download/
- download profile "Yuneec Q500 v1.5" from http://www.drohnen-forum.de/index.php/Thread/12303-ST2Dash-der-Flightlog-Konverter-f%C3%BCr-die-ST10-Q500/
- unzip "Yuneec Q500 v1.5.xml" and copy it to the Profile directory of DashWare: %HOMEPATH%\Documents\DashWare\DataProfiles\
- restart DashWare. Now the new profile for Yuneec telemetry data from ST2DASH or q500log2kml is available every time you use DashWare. Done.

Step 2: Convert telemetry file to DashWare format that fits the profile:
- download and install "q500log2kml" from here: http://h-elsner.mooo.com/downloads/q500log2kml_en.zip
- read the description (OK, this you have done at this point)
- select Data conversion output format "dashw.csv" in tab "Settings"
- convert all the telemetry data of real flights in one step to DashWarefiles by click on Convert

Step 3: Use video files and fitting converted DashWarefile (i.e. Telemetry000xxdashw.csv):
- start DashWare - create a new project
- add one or more video files (I guess DashWare cannot use 4k videos, it must be downsized)
- add converted DashWarefile (i.e. Telemetry000xxdashw.csv) as data logger file
- select "Yuneec Q500 v1.5" as relating profile
- synchronize telemetry/video and do all the stuff that you want to do with your project...