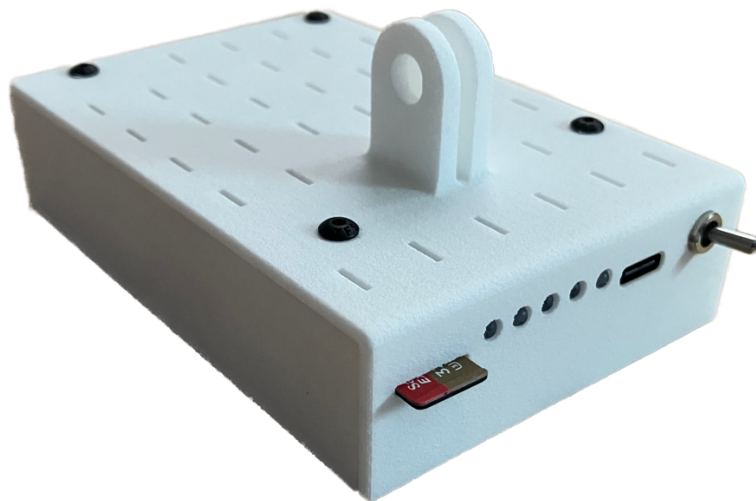


# OnFlight Hub CSV Data Log Description

Firmware v1.0 and v2.0

Document Revision 1.1



## Table of Contents

1	Technical Documentation .....	3
2	Support.....	3
3	Introduction .....	3
4	Orientation .....	3
5	Data Fields.....	4
5.1	System Status.....	4
5.2	Inertial Measurement Unit (IMU) .....	4
5.3	Magnetometer.....	5
5.4	Static Pressure Sensor.....	5
5.5	Global Navigation Satellite System (GNSS) .....	5
5.6	Inertial Navigation System (INS) .....	6
5.7	Air Data Computer (ADC).....	7
5.8	External Air Data .....	7
5.9	External AGL Altitude.....	8

## Document Revisions

**1.0:** initial baseline

**1.1:** added description of external air data and external AGL altimeter fields after updating the converter software to support them.

## 1 Technical Documentation

The following documentation and support software are included with OnFlight and available from our [website](#):

- **User Manual:** describes the OnFlight Hub, specifications, and operations.
- **CSV Data Log Description (this document):** describes the fields available in the CSV formatted data logs.
- **Binary Data Log Description:** describes the binary data log format that OnFlight Hub uses to write data. This is useful for application developers who would like to natively read and use these data logs.
- **UDP Broadcast Description:** describes the real-time UDP broadcast packet format that is sent by OnFlight Hub.
- **External Air Data Interface:** describes the interface to send OnFlight Hub data from an external air data system.
- **External AGL Altimeter Interface:** describes the interface to send OnFlight Hub data from an external Above Ground Level (AGL) altimeter.
- **Data Converter:** application for Windows or MacOS, which converts the data from OnFlight to CSV format.

## 2 Support

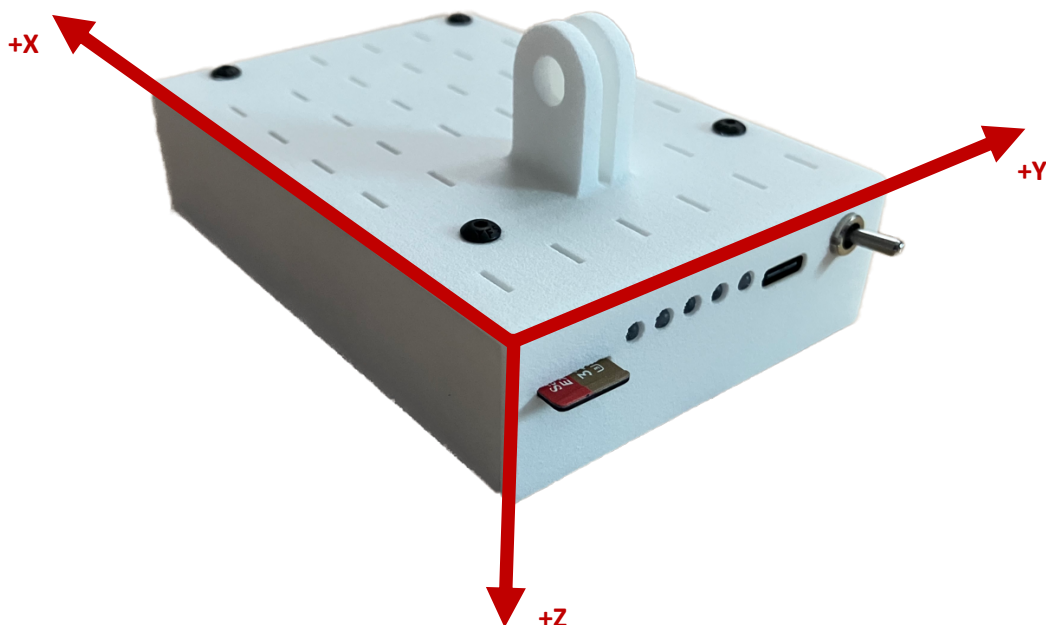
If you have technical problems or cannot find the information you need in the provided documents, please contact our technical support team by email at: [support@bolderflight.com](mailto:support@bolderflight.com). Our team is committed to providing the support necessary to ensure that you are successful using our products.

## 3 Introduction

One of the available data formats for converting OnFlight data logs is Comma Separated Values (CSV). CSV is a text format that uses commas to separate values. The first row in the CSV file are short data field names and the following rows are the data records. The advantage of CSV is that it can be opened by a wide variety of open-source and proprietary programs to read and analyze the data.

## 4 Orientation

Accelerometer, gyro, and magnetometer data is given as 3-axis data in the following orientation.



Note that, because of how the OnFlight Hub is aligned with the aircraft, or the configured rotation matrix, this corresponds to the x-axis being out the aircraft nose, the y-axis out the right wing, and the z-axis down. Rotations are positive right-hand rotations about the corresponding axis. For example, x-axis gyro data is measuring the aircraft roll rate (positive roll right), y-axis gyro the pitch rate (positive pitch up), and z-axis gyro the yaw rate (positive yaw right).

## 5 Data Fields

The following table provides the column number, data field names, and a brief description of each of the data fields.

The CPU, IMU, magnetometer, and static pressure sensors all report their internal temperature. These components all have internal temperature limits of -40 C to +80 C and the temperature is reported as ok if the measured temperature falls within -30 C to +70 C.

Health is reported for each of the OnFlight sensors. A sensor is determined to be unhealthy if 5 or more frames of communication are missed in a row at the expected sampling rate.

### 5.1 System Status

These fields give OnFlight system status information.

Column	Field Name	Description
1	sys_time_s	Time since boot, seconds with milli-second resolution.
2	sys_batt_status	Battery status, 0 = battery voltage above the configured warning voltage, 1 = battery voltage between configured warning and low voltages, and 2 = battery voltage below the configured low voltage.
3	sys_temp_ok	True if all the subsystem temperatures are ok.
4	input_volt	Input voltage to OnFlight Hub. When plugged into USB-C, this will be the voltage of the USB-C input. On battery, this will be the battery voltage.
5	filt_input_volt	Low pass filtered input voltage.
6	cpu_die_temp_ok	True if the CPU die temperature is within -30 C to + 70 C.
7	cpu_die_temp_c	OnFlight CPU die temperature, degrees C.

### 5.2 Inertial Measurement Unit (IMU)

These fields give the data from the integrated Inertial Measurement Unit (IMU), which is a solid-state sensor that measures the aircraft's acceleration and rotational rate.

Column	Field Name	Description
8	imu_new_data	True if new data was read from the IMU this frame.
9	imu_healthy	False if no new data was read from the IMU for the previous 5 frames in a row.
10	imu_die_temp_ok	True if the IMU die temperature is within -30 C to + 70 C.
11	imu_die_temp_c	OnFlight Hub IMU die temperature, degrees C.
12	imu_accel_x_g	Measured acceleration in the x-axis, g.
13	imu_accel_y_g	Measured acceleration in the y-axis, g.
14	imu_accel_z_g	Measured acceleration in the z-axis, g.
15	imu_gyro_x_dps	Measured rotational rate in the x-axis, deg/s.
16	imu_gyro_y_dps	Measured rotational rate in the y-axis, deg/s.
17	imu_gyro_z_dps	Measured rotational rate in the z-axis, deg/s.

## 5.3 Magnetometer

These fields give the data from the integrated magnetometer, which is a solid-state sensor used to measure magnetic field intensity and is used to provide an initial heading to the Inertial Navigation System (INS).

Column	Field Name	Description
18	mag_new_data	True if new data was read from the magnetometer this frame.
19	mag_healthy	False if no new data was read from the magnetometer for the previous 5 frames in a row.
20	mag_die_temp_ok	True if the magnetometer die temperature is within -30 C to + 70 C.
21	mag_die_temp_c	OnFlight Hub magnetometer die temperature, degrees C.
22	mag_x_ut	Measured magnetic field in the x-axis, uT.
23	mag_y_ut	Measured magnetic field in the y-axis, uT.
24	mag_z_ut	Measured magnetic field in the z-axis, uT.

## 5.4 Static Pressure Sensor

These fields give the data from the integrated static pressure sensor, which is used to measure the cabin pressure and cabin pressure altitude. In non-pressurized aircraft, this is approximately the same as the aircraft static pressure and pressure altitude.

Column	Field Name	Description
25	pres_new_data	True if new data was read from the pressure sensor this frame.
26	pres_healthy	False if no new data was read from the pressure sensor for the previous 5 frames in a row.
27	pres_die_temp_ok	True if the pressure sensor die temperature is within -30 C to + 70 C.
28	pres_die_temp_c	OnFlight Hub pressure sensor die temperature, degrees C.
29	pres_pa	Measured static pressure, Pa.

## 5.5 Global Navigation Satellite System (GNSS)

OnFlight Hub utilizes a GNSS-aided Inertial Navigation System (INS) for estimating attitude and inertial position, velocity, and acceleration data. These fields give the GNSS status, UTC time, measurement accuracy, GNSS doppler measured inertial velocity in a North-East-Down (NED) sense, and measured position and altitude.

Column	Field Name	Description
30	gnss_new_data	True if new data was read from the GNSS receiver this frame.
31	gnss_healthy	False if no new data was read from the GNSS receiver for the previous 5 frames in a row at the configured rate.
32	gnss_fix	GNSS fix status, 0 = no fix, 2 = 2D fix, 3 = 3D fix, 4 = differential GNSS.
33	gnss_num_sv	Number of GNSS satellites used in the solution.
34	gnss_utc_year	UTC year.
35	gnss_utc_month	UTC month.
36	gnss_utc_day	UTC day.
37	gnss_utc_hour	UTC hour.
38	gnss_utc_min	UTC min.
39	gnss_utc_sec	UTC second.
40	gnss_horz_pos_acc_ft	Estimated horizontal position accuracy, ft.
41	gnss_vert_pos_acc_ft	Estimated vertical position accuracy, ft.
42	gnss_vel_acc_kts	Estimated velocity accuracy, knots.

43	gnss_ned_vel_x_kts	Measured inertial velocity in a north / south direction, positive north, knots.
44	gnss_ned_vel_y_kts	Measured inertial velocity in an east / west direction, positive west, knots.
45	gnss_ned_vel_z_kts	Measured inertial velocity in a up / down direction, positive down, knots.
46	gnss_geoid_height_ft	The geoid height (i.e. the difference between WGS84 and MSL altitude), ft.
47	gnss_alt_wgs84_ft	The height above the WGS84 ellipsoid, ft.
48	gnss_alt_msl_ft	The height above Mean Sea Level (MSL), ft.
49	gnss_lat_deg	Latitude, deg.
50	gnss_lon_deg	Longitude, deg.

## 5.6 Inertial Navigation System (INS)

These fields give the INS status and state estimation results. The INS will initialize when new data is received from the IMU, magnetometer, and GNSS and the GNSS has at least a 3D solution with 10 or more satellites. The INS is considered healthy if the IMU and GNSS are healthy with at least a 3D GNSS fix and a solution using 10 or more satellites. The heading, track, and flight path angle are considered inaccurate at speeds below about 10 knots.

Column	Field Name	Description
51	ins_initialized	True if the INS has been initialized.
52	ins_healthy	True if the INS is healthy.
53	ins_pitch_deg	Pitch, positive nose up, deg.
54	ins_roll_deg	Roll, positive roll right, deg.
55	ins_mag_var_deg	Magnetic variation, +/-180, deg (positive east).
56	ins_heading_true_deg	Heading (true), 0 – 360, deg.
57	ins_heading_mag_deg	Heading (mag), 0 – 360, deg.
58	ins_climb_rate_ftpm	Climb rate, ft/min.
59	ins_load_factor	Load factor.
60	ins_accel_x_g	Acceleration in the x-axis with biases estimated and removed in real-time and low-pass filtering applied, g.
61	ins_accel_y_g	Acceleration in the y-axis with biases estimated and removed in real-time and low-pass filtering applied, g.
62	ins_accel_z_g	Acceleration in the z-axis with biases estimated and removed in real-time and low-pass filtering applied, g.
63	ins_gyro_x_dps	Rotational rate in the x-axis with biases estimated and removed in real-time and low-pass filtering applied, deg/s.
64	ins_gyro_y_dps	Rotational rate in the y-axis with biases estimated and removed in real-time and low-pass filtering applied, deg/s.
65	ins_gyro_z_dps	Rotational rate in the z-axis with biases estimated and removed in real-time and low-pass filtering applied, deg/s.
66	ins_mag_x_ut	Magnetic field in the x-axis with low-pass filtering applied, uT.
67	ins_mag_y_ut	Magnetic field in the y-axis with low-pass filtering applied, uT.
68	ins_mag_z_ut	Magnetic field in the z-axis with low-pass filtering applied, uT.
69	ins_ned_vel_x_kts	Inertial velocity in a north / south direction, positive north, knots.
70	ins_ned_vel_y_kts	Inertial velocity in an east / west direction, positive west, knots.
71	ins_ned_vel_z_kts	Inertial velocity in a up / down direction, positive down, knots.
72	ins_gnd_spd_kts	Ground speed, knots.
73	ins_gnd_track_true_deg	Ground track (true), 0 – 360, deg.
74	ins_gnd_track_mag_deg	Ground track (mag), 0 – 360, deg.
75	ins_flt_path_deg	Flight path angle, +/-90, positive up, deg

76	ins_alt_wgs84_ft	Height above the WGS84 ellipsoid, ft.
77	ins_alt_msl_ft	Height above Mean Sea Level, ft.
78	ins_lat_deg	Latitude, deg.
79	ins_lon_deg	Longitude, deg.

## 5.7 Air Data Computer (ADC)

An onboard Air Data Computer (ADC) filters the static pressure sensor data and uses that to estimate the cabin pressure altitude. The ADC is considered healthy when the static pressure sensor is healthy.

Column	Field Name	Description
80	adc_healthy	True if the ADC is healthy.
81	adc_pres_pa	Low pass filtered static pressure, Pa.
82	adc_pres_alt_ft	Pressure altitude, ft.

## 5.8 External Air Data

An option external air data probe can be used with the OnFlight Hub. Data is sent wirelessly to OnFlight Hub using a defined interface. Please see the *External Air Data Interface* document for details. Data from this external air data probe is logged and made available in the following fields.

Column	Field Name	Description
83	airdata_connected	True if an external air data sensor is connected to the OnFlight Hub. This requires OnFlight Hub receiving a message from the external air data sensor at least once every 5 seconds.
84	airdata_new_msg	True if a new message was received from an external air data sensor.
85	airdata_batt_status	Battery status, 0 = battery voltage above the configured warning voltage, 1 = battery voltage between configured warning and low voltages, and 2 = battery voltage below the configured low voltage.
86	airdata_die_temp_ok	True if all the air data subsystem temperatures are ok.
87	airdata_die_temp_c	The air data subsystem die temperature that's closest to a limit, C.
88	airdata_static_pres_new_data	True if new data was read from the static pressure sensor this frame.
89	airdata_static_pres_healthy	False if no new data was read from the pressure sensor for the previous 5 frames in a row.
90	airdata_static_pres_pa	Low pass filtered static pressure, Pa.
91	airdata_diff_pres_new_data	True if new data was read from the differential pressure sensor this frame.
92	airdata_diff_pres_healthy	False if no new data was read from the pressure sensor for the previous 5 frames in a row.
93	airdata_diff_pres_pa	Low pass filtered differential pressure, Pa.
94	airdata_oat_avail	True if Outside Air Temperature (OAT) is measured from the external air data probe.
95	airdata_oat_new_data	True if new data was read from the OAT sensor this frame.
96	airdata_oat_healthy	False if no new data was read from the OAT sensor for the previous 5 frames in a row.
97	airdata_oat_c	Low pass filtered OAT, C.
98	airdata_aoa_avail	True if Angle of Attack (AOA) is measured from the external air data probe.
99	airdata_aoa_type	0 if the angle of attack data is given in degrees, 1 if the angle of attack data is given as a pressure ratio.
100	airdata_aoa_new_data	True if new data was read from the AOA sensor this frame.

101	airdata_aoa_healthy	False if no new data was read from the AOA sensor for the previous 5 frames in a row.
102	airdata_aoa	AOA.
103	airdata_kias	Indicated airspeed, knots.
104	airdata_ktas	True airspeed, knots.
105	airdata_pres_alt_ft	Pressure altitude, ft.
106	airdata_density_alt_ft	Density altitude, ft.

## 5.9 External AGL Altitude

An option external Above Ground Level (AGL) altimeter can be used with the OnFlight Hub. Data is sent wirelessly to OnFlight Hub using a defined interface. Please see the *External AGL Altimeter Interface* document for details. Data from this external AGL altimeter is logged and made available in the following fields.

Column	Field Name	Description
107	agl_alt_connected	True if an external AGL altimeter is connected to the OnFlight Hub. This requires OnFlight Hub receiving a message from the external AGL altimeter at least once every 5 seconds.
108	agl_alt_new_msg	True if a new message was received from an external AGL altimeter.
109	agl_alt_batt_status	Battery status, 0 = battery voltage above the configured warning voltage, 1 = battery voltage between configured warning and low voltages, and 2 = battery voltage below the configured low voltage.
110	agl_alt_die_temp_ok	True if all the AGL altimeter subsystem temperatures are ok.
111	agl_alt_die_temp_c	The AGL altimeter subsystem die temperature that's closest to a limit, C.
112	agl_alt_new_data	True if new data was read from the AGL altimeter sensor this frame.
113	agl_alt_healthy	False if no new data was read from the AGL altimeter sensor for the previous 5 frames in a row.
114	agl_alt_in_range	True if the AGL altimeter is in range.
115	agl_alt_ft	Measured AGL altitude, ft.