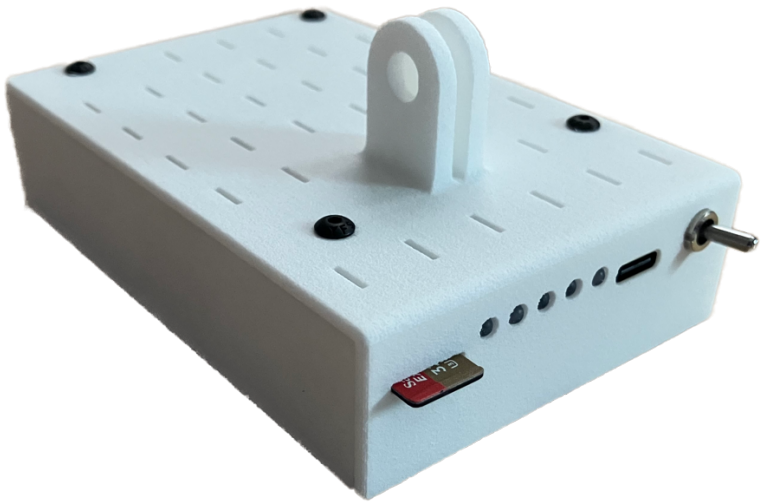
OnFlight Hub CSV Data Log Description

Firmware v1.0

Document Revision 1.0



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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.
- **Data Converter:** application for Windows or MacOS, which converts the data from OnFlight to CSV format.

2 Support

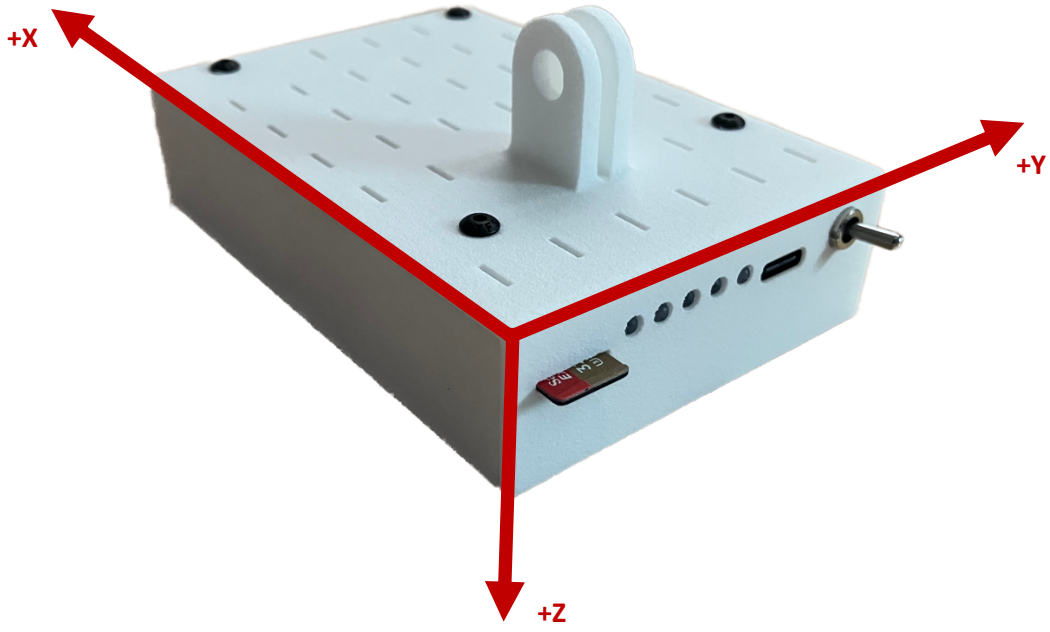
If you have technical problems or cannot find the information you need in the provided documents, please contact our technical support team by email at: support@bolderflight.com. Our team is committed to providing the support necessary to ensure that you are successful using our products.

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, 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 3.6V, 1 = battery voltage between 3.4V and 3.6V, and 2 = battery voltage below 3.4V.
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. Note that the GNSS receiver has an expected rate of 10 Hz.
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.