STRATO FLIGHTS

Datalogger STRATO4

Datalog your space mission

Foreword

Thank you for your trust in our Datalogger STRATO4 and your interest in this special mission. We would like to offer you the opportunity to experience an unforgettable adventure with breath-taking video recordings of an altitude where planes have not flown for a while and the blackness of our space and the blue of our planet become visible: The stratosphere! The Datalogger STRATO4 will collect flight data during your mission for you to unravel the secret of the reached altitude, the extreme temperature and more.

Stratoflights has been carrying out flights into the stratosphere since 2011. Initially conceived as a single private film project, our founding team has created with this project the opportunity to make the stratosphere accessible to everyone. Whether for research flights, school experiments, commercials or just as a pure (family) adventure- a stratosphere project is pure fascination and adventure. That's a promise!

So that you can join the „Hall of Fame" of STRATOnauts, we have put together the best equipment for you from our experience of over 1,000 stratospheric flights in our shop to carry out your own research mission into the stratosphere. When we could not find the optimal equipment on the worldwide market, we have developed, with the help our engineers, our own products to create perfect conditions for a successful flight. So far, we have developed parachutes, battery packs, dataloggers, the GPS tracker STRATOfinder and even Weather Balloons according to our own requirements and have them made to meet the needs of our customers from all over the world and intended for a broad range of industry and applications.

In addition to high quality equipment, we offer you an instruction for recording the data of your stratospheric flight. This guide will not only help you to install and use STRATO4 correctly but will also show you how to analyse and visualise the recordings by using different tools.

To be well prepared for your stratospheric mission, be sure to check out the tutorial on our website. You will also find on the website helpful tools and a free app which will support you during your mission with lots of little extras.

If you need more equipment or are simply interested in a detailed manual, which describes in detail the
stratosphere mission on 100 pages and is accompanied by countless pictures as well as tips and tricks, please have a look at the Weather Balloon guide in our shop.

We are wishing you a lot of fun, success, and great video recordings of your adventure 'stratosphere flight'!

Your Stratoflights team

1 Inhaltsverzeichnis

1   General notes

Before using: Please complete reading attentively the instructions of the Datalogger STRATO4 before operating with the Datalogger STRATO4 for the first time. Please follow the steps and order exactly as described here to ensure an error-free setup, operation and analysis of the recorded data. Please keep the manual in a safe space. If you lose the manual, you can download it again from your costumer account on www.stratoflights.com.

1.1   Features

Your Datalogger STRATO4 comes with the following features:

- Unlocked GPS module: Stores data up to 50,000 metres altitude. Most GPS modules block from an altitude of 18,000 metres!
- Saves the data every 2 seconds on a micro SD card as a .csv file.
- Simple evaluation of the data by reading out the micro SD card.
- Simple operation, no programming knowledge required.
- Online tool: Datalogger evaluation to create graphs
- Online-Tool: Datalogger evaluation to create a 3D flight curve in Ayvri
- Online-Tool: Datalogger evaluation for creating a 2D and 3D flight curve in Google Earth.
- UART data interface: For reading out measured values and GPS data
- Lightweight and space-saving design (72g) with large colour display.
- Battery operation (9V).
- Measured values from the Datalogger STRATO4 are covered in the Stratospheric Flight lesson series.

1.2   Measuring data

The following measurement data are recorded by your Datalogger STRATO4 and are available for measurement data analysis:

- Current running time
- Time (UTC)
- Date
- GPS signal quality
- Number of satellites used
- GPS position (longitude and latitude)

- Speed over ground
- Rate of ascent and descent
- Flight altitude
- Inside temperature
- Outdoor temperature
- Humidity
- Air pressure
- Light intensity white
- Light intensity red
- Light intensity green
- Light intensity blue
- Infrared
- UV-A radiation
- Battery voltage
- On-board voltage
- Input voltage I
- Input voltage II
- Input voltage III
- External input trigger I
- External input trigger II
- Output trigger I
- Output trigger II

1.3   Scope of delivery

The STRATO4 will be delivered with the following contents. After unpacking, immediately check the contents to make sure that everything is there, using this list:

- Datalogger STRATO4
- Micro SD card
- Wired sensor board (already plugged in)
- Charging cable (already plugged in)
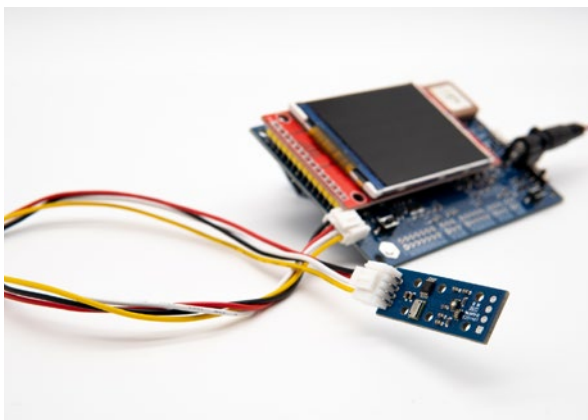- Available at request: 9V batteries for the Datalogger

1.4   Product view

The following pictures are shown to provide a comprehensive impression of the Datalogger STRATO4:

1.5   Quick start guide

To set up your Datalogger STRATO4, you can use this guide about quick starting the Datalogger. Please keep in mind that all steps of the quick start are shortened, there-

fore it makes sense to have a look at the more detailed description, which contains useful tips and tricks. If you are not making any progress, please view the following chapter, where each step is explained fully.
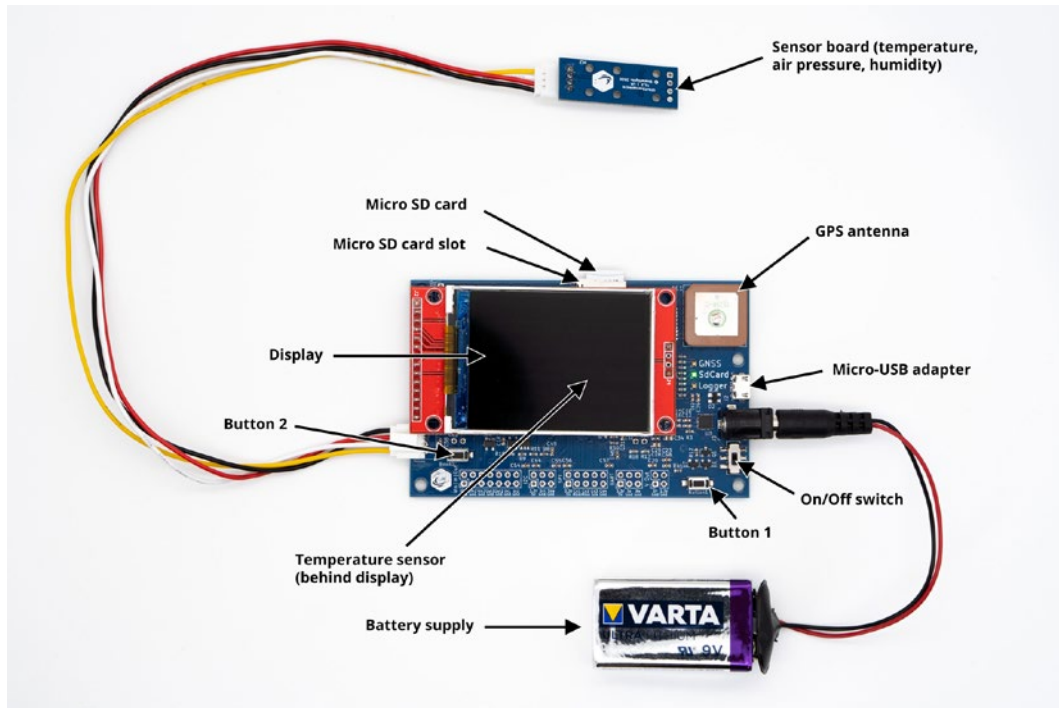
1. First check if the Datalogger STRATO4 is connected to the sensor board via the data cable (approximately 30m) at the white plug connection.
2. Insert the supplied micro SD card into the card slot until it clicks into place.
3. Check if the cable for power supply is in the socket. Connect the 9V-battery pack (if delivered)
4. To turn on the Datalogger STRAO4, press the on/off button. The STRATO4 is now switched on, active and starts to record from the beginning every two seconds all measured values. It saves the data on the micro SD card.
5. Attach your STRATO4 horizontally inside your stratospheric probe. For this step, you can use double-sided adhesive tape or Tesa tape.
6. The sensor board with the approximately 30m long data cable must be attached outside of the stratospheric probe to measure, for example, the temperature outside. Do not tape over the sensor board, otherwise the small sensors will be covered and no or false measurement will be measured. Therefore, only use tape on the data cable.
7. After your successful stratosphere flight has been successful and you have recovered your research probe, press for two seconds the menu bottom (button 1) which is on the right hand side so that the Datalogger STRATO4 can save your data and shut down. Only after you have shut down the Datalogger by pressing button 1 and it signals that it can be switched off, you can press the on/off but-

ton. If you press immediately the on/off button, data will get lost!

8. Remove the micro SD card from the Datalogger. Just to be safe, you should save the data of your flight to another storage medium.

9. The .csv file, written by the Datalogger, can be evaluated with Excel or directly with the tool 'Datalogger Evaluation' on the website www.stratoflights. The Datalogger Evaluation tool gives you information about the extreme measurements briefly and allows you to correlate all parameters in different graphs and analyse your stratospheric flight in detail.

**https://www.stratoflights.com/en/tutorial/datalogger-evaluation/**

2   How to use the STRATO4

2.1   Preparatory measures

First check if the approx. 30m long data cable is connected to the white connector on the large blue circuit board of the Datalogger STRATO4. Please also check if the plug for power supply is completely in the socket. Now connect the 9V battery to the Datalogger. The measuring data of the Datalogger will be now saved every two seconds on the supplied micro SD card. To ensure this, insert now carefully by pushing the micro SD card into the card slot until the micro SD card is snapped in. The following pictures are illustrating the steps mentioned above:
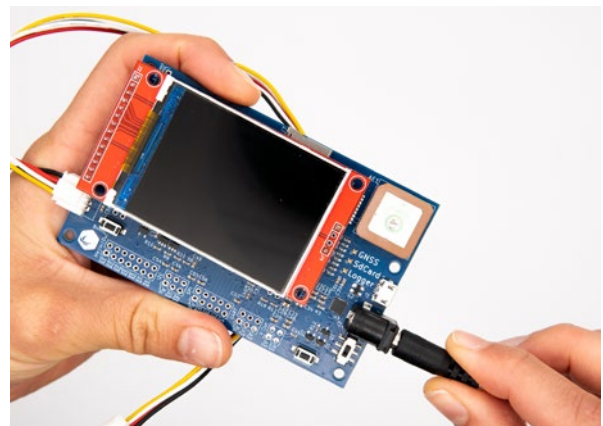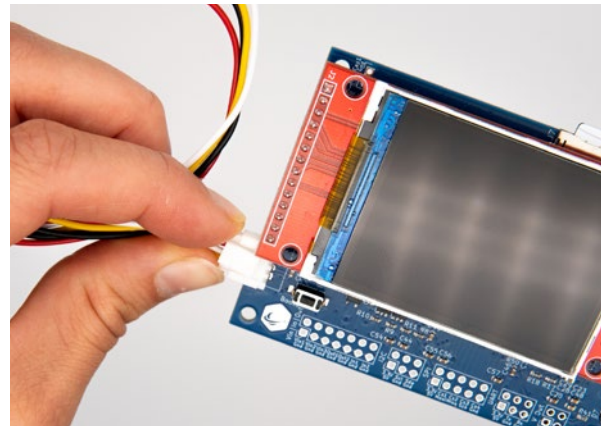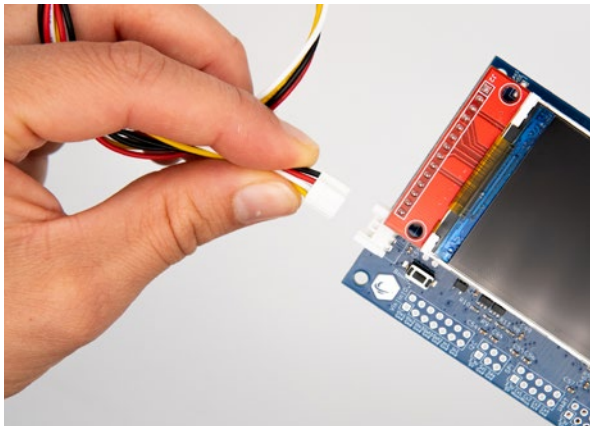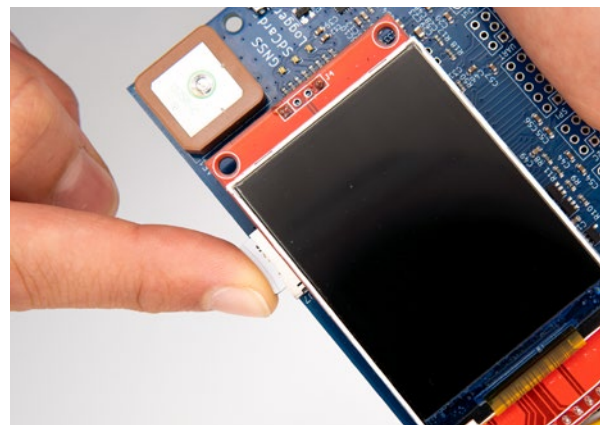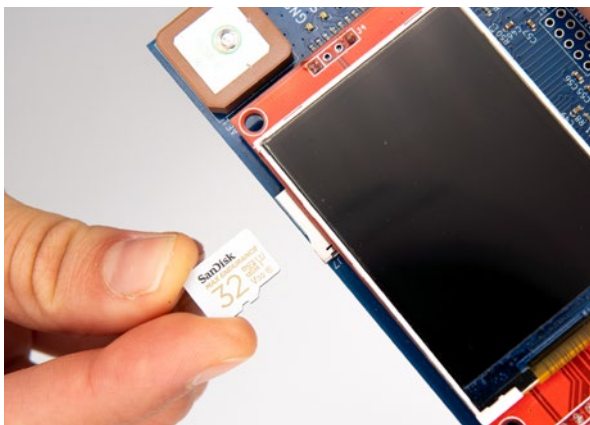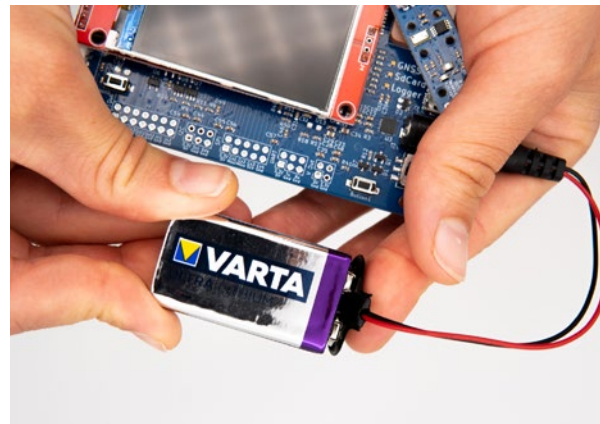
2.2   Switching on

By pushing the on/off button, you can turn on the Datalogger STRATO4. After the slide switch is flipped, the STRATO starts automatically and the display lights up. The recording of the measuring data starts right after switching on the Datalogger. You do not need to press a separate button to start the recordings.

On/Off switch
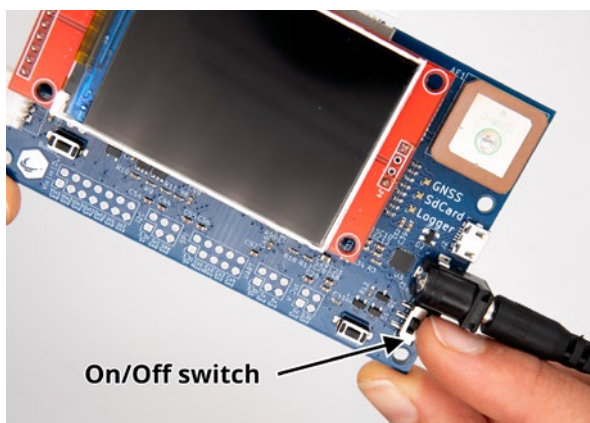
2.3   Use

As soon as the STRATO4 is turned on, it starts recording the measuring data automatically. The measuring data will be saved on the micro SD card as .csv file. Please consider that a complete function test should be carried out exclusively outdoors with a clear view of the sky. The GPS antenna can only establish a reliable connection to the GPS satellite outdoors.
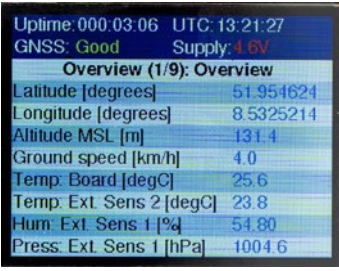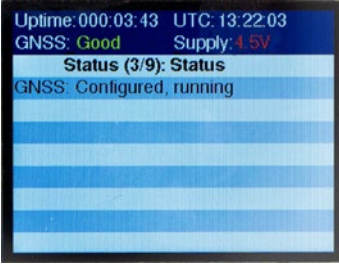
While turning on the Datalogger and the search for satellites a red LED light at "GNSS" lights up. If the micro SD card is inserted, the LED next to "SdCard" starts to light up green directly. As soon as everything is working properly, the GnSS LED changes from flashing in red to green, so it signals a valid GPS signal. If both LED lights are flashing in green, the device is ready to be used.

Note: There is a GPS antenna on the Datalogger to determine position and height. The GPS signal can not be received inside flats, houses, cellars, freezers, under roofs of metal, etc., just like any other navigation system! Use the STRATO4 outdoors and place it under clear sky for a few minutes. This way it can establish a connection with the GPS satellites. It may take a few minutes to establish the connection. Installing it in your stratospheric Polystyrene probe is no problem at all, as well as keeping it close to other GPS trackers and different electronic devices available in the Stratoflights shop.
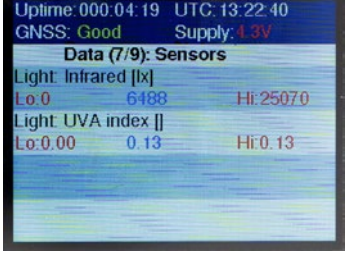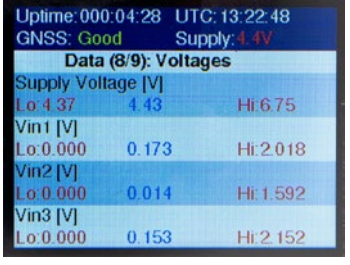
By pressing the menu button (button 1) you can see different views of the menu. In the following nine menu displays, starting with "Overview (1/9)" till "Infos (9/), are explained. These are the most important information. You can easily read them all at a glance after your flight. A more detailed analysis is possible with the tool Datalogger Evaluation. This will be explained in a latter chapter.

At the top each overview screen contains information like operating time (Uptime); time in UTC format (UTC), quality of the satellite connection (GNSS: Good) as well as an information about the voltage of the power supply (Supply). The nine different menu displays will be explained now in a shortened version:

|	
Uptime: 000:03:06 UTC: 13:21:27 GNSS: Good Supply: 4.6V **Overview (1/9): Overview** Latitude [degrees] 51.954624 Longitude [degrees] 8.5325214 Altitude MSL [m] 131.4 Ground speed [km/h] 4.0 Temp: Board [degC] 25.6 Temp: Ext. Sens 2 [degC] 23.8 Hum: Ext. Sens 1 [%] 54.80 Press: Ext. Sens 1 [hPa] 1004.6	**Overview (1/9): Overview:** A snapshot of the most important information such as latitude and longitude, height (altitude MSL), ground speed, temperature on board (Temp: Board) of the Datalogger, temperature of the sensor board (Temp: Ext. Sens 2), humidity (Hum: Ext. Sens 1) and air pressure (Press: Ext. Sens 1) is displayed.
Uptime: 000:03:30 UTC: 13:21:51 GNSS: Good Supply: 4.5V **Status (2/9): Status** Syslog file: 13_syslog.log Datalog file: 13_datalog.log CSV file: 12_csv_data.csv LM75 Ext: Configured, running MS8607 Ext: Configured, running VEML3328: Configured, running VEML6070: Configured, running Tf4kka: Examining	**Status (2/9): Status:** A snapshot of the completed ready status and the note under which file name the current data is recorded: "12_csv_data". The remaining values indicate the ready status of the controllable modules, which can be developed and connected independently.
Uptime: 000:03:43 UTC: 13:22:03 GNSS: Good Supply: 4.5V **Status (3/9): Status** GNSS: Configured, running	**Status (3/9): Status:** A snapshot of whether there is a connection to the GPS satellites. GNSS is an abbreviation for Global Navigation Satellite System and includes all navigation devices which are based on satellites, such as: GPS; GLONAS; BEIDOU; GALILEO and many more.
Uptime: 000:03:52 UTC: 13:22:13 GNSS: Good Supply: 4.4V **Data (4/9): GNSS** Latitude [degrees] Lo: 51.95461 51.9546305 Hi: 51.95469 Longitude [degrees] Lo: 8.532500 8.5325352 Hi: 8.532586 Altitude MSL [m] Lo: 123.3 125.4 Hi: 134.5 Ground speed [km/h] Lo: 0.0 0.3 Hi: 6.6	**Data (4/9): GNSS:** The average is displayed in blue, for example the current altitude (Altitude MSL) (125,4m), whereas "Lo" stands for the lowest height since the beginning of the recording (123.3m) and „Hi" indicates the highest altitude (134.5m) since the beginning of the recording. Thus, latitude and longitude are displayed in the unit "degrees". The ground speed is displayed in the unit km/h.
Uptime: 000:04:03 UTC: 13:22:24 GNSS: Good Supply: 4.4V **Data (5/9): Sensors** Temp: Board [degC] Lo: 23.2 26.0 Hi: 26.1 Temp: Ext. Sens 2 [degC] Lo: 22.8 23.4 Hi: 23.8 Press: Ext. Sens 1 [hPa] Lo: 1004.2 1004.5 Hi: 1004.8 Hum: Ext. Sens 1 [%] Lo: 51.98 52.50 Hi: 58.10	**Data (5/9): Sensors:** For example, the value shown in the centre (blue) is representing the current temperature (Temp: Board) (26,0) on the Datalogger. "Lo" shows the lowest temperature (23.2) and „Hi" indicates the highest measured temperature (26.1) on the board since the beginning of the recording. The temperature on the sensor board (Temp: Ext. Sens 2), the air pressure on the sensor board (Press: Ext. Sens 1) and the humidity on the sensor board (Hum: Ext: Sens 1) are displayed like this as well.

Uptime:000:04:12 UTC:13:22:32 GNSS: Good Supply:4.4V **Data (6/9): Sensors** Light: Clear [lx] Lo:0 8593 Hi:25107 Light: Red [lx] Lo:0 16427 Hi:24977 Light: Green [lx] Lo:0 23906 Hi:25085 Light: Blue [lx] Lo:0 23408 Hi:25068	**Data (6/9): Sensors:** For example, the current light intensity white (Light: Clear) (8593) is displayed via the value in the centre (blue). "Lo" displays the lowest light intensity (0) and "Hi" indicates the highest light intensity (25107). In this way, the light intensity red (Light: Red) and the light intensity green (Light: Green) and blue (Light: Blue) are also displayed.
Uptime:000:04:19 UTC:13:22:40 GNSS: Good Supply:4.3V **Data (7/9): Sensors** Light: Infrared [lx] Lo:0 6488 Hi:25070 Light: UVA index [] Lo:0.00 0.13 Hi:0.13	**Data (7/9): Sensors:** For example, it displays the current value of infrared (Light: Infrared) (6488) via the value in the centre (blue). „Lo" displays the lowest infrared value (0) and „Hi" indicates the highest infrared value (25070) since the beginning of the recording. The UVA index (Light: UVA index) is also shown like this.
Uptime:000:04:28 UTC:13:22:48 GNSS: Good Supply:4.4V **Data (8/9): Voltages** Supply Voltage [V] Lo:4.37 4.43 Hi:6.75 Vin1 [V] Lo:0.000 0.173 Hi:2.018 Vin2 [V] Lo:0.000 0.014 Hi:1.592 Vin3 [V] Lo:0.000 0.153 Hi:2.152	**Data (8/9): Voltages:** For example, displays the current value of voltage (Supply Voltage) (4,37). Lo" shows the lowest value of voltage (4.37) and „Hi" indicates the highest measured value of the voltage (6.75) since the beginning of the recording. VIN 1-3 indicate the input voltage at the header if self-developed extensions are connected to the STRATO4.
Uptime:000:04:37 UTC:13:22:56 GNSS: Good Supply:4.3V **Infos (9/9): Infos** SW Version:0.1.0 SW Version:Jul 2 2021 09:50:43	**Infos (9/9): Infos:** The first row shows the version of the firmware (SW version) which is currently installed on the Datalogger STRATO4. The second row shows the time stamp of when the compilation took place.

Note: The GPS module has different modifications according to the producers, which can be configured depending on the area of application. The aim of the Datalogger STRATO4 is a flight to the stratosphere and therefore reaching up to 50 kilometres. That is why the so called "Airborne Mode" needs to be used. This mode unlocks the GPS module for altitudes above 18 kilometres and enables that the data of GPS position can be recorded up to 50 kilometres. However, this mode is less accurate for stationary applications or „ground tests" such as with a bicycle or car. If you notice any jumps regarding to the recording of measuring data on the ground, such as ground speed, this is due to the Airborne Mode! As soon as the STRATO4 ascends towards the stratosphere, it will be used in a perfect environment for the STRATO4 and has optimal reception of GPS if installed correctly. Every Datalogger STRATO4

is produced in Germany and undergoes a multi-stage function test for complete and immediate readiness for use.

2.4   Switching on/off

In order to switch off your STRATO4 after your successful flight to the stratosphere accurately or after a test run outdoors, it is important to press for about two seconds the menu button (button 1).
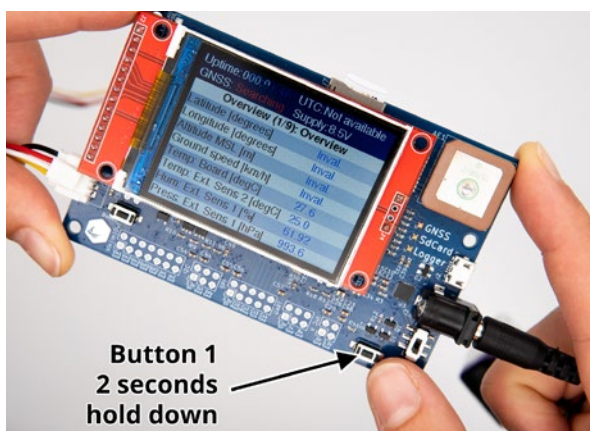
Only after the Datalogger has shut down, you are allowed to switch the power button off which will be signalled by the message "Logger is shut down! You can power off the device now". At last, remove the lithium 9V Battery from the cable for power supply.

Note: If you do not follow these steps and the order correctly, it may lead to loss of your data and therefore you will not receive any data about your flight. Please have this in mind and be sure to follow the steps mentioned above.

3   Installation

3.1   Attaching STRATO4

Extreme temperatures are raging in the stratosphere (example: temperatures of -65°C). Consequently, the whole technical equipment must be installed inside of the Polystyrene probe to protect everything from the extreme temperature, e. g. to prevent the display of the Datalogger STRATO4 from freezing. The thickness of the wall of the stratospheric probe does not present any problem for the quality of reception of the GPS antenna.

The Datalogger STRATO4 has some holes (in its corners) which can be used to fasten the Datalogger to the Polystyrene probe with, for example, toothpicks. This ensures that the Datalogger will not slip out of place. For optimal reception, the GPS antenna and thus the STRATO4 should lie horizontally, more or less on the „bottom" of the Polystyrene probe. In this position, the display faces the lid or the sky.
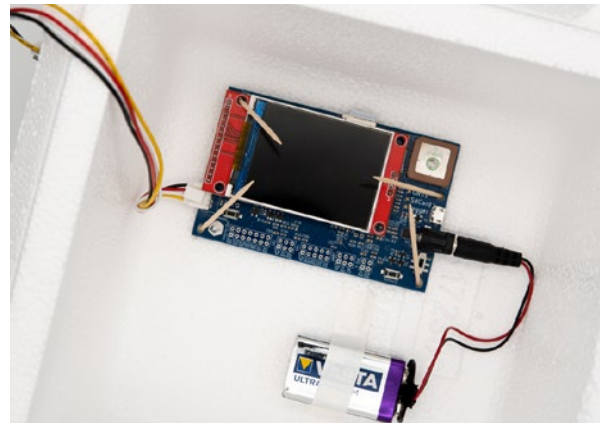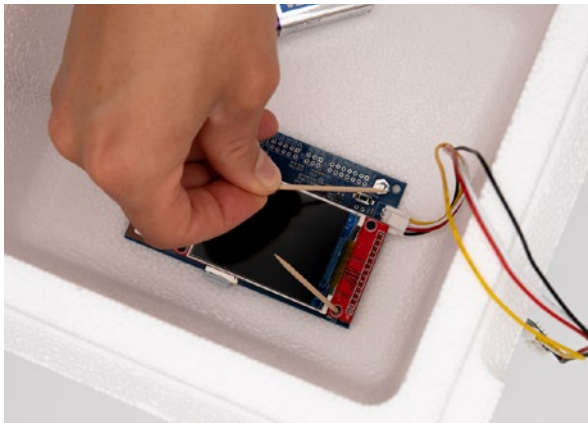

3.2   Attaching the sensor board

To record measured values outside your stratospheric probe, the sensor board must be attached outside the probe, e.g. for it to measure the UV radiation and the external temperature. The data cable between the blue circuit board of the Datalogger STRATO4 is connected to the sensor board via a 30cm long data cable. Two possible examples for attaching the sensor board outside of the probe are:

A) Cut a small slit in the upper side of your stratospheric probe, so you can pull the data cable through the slit towards the exterior and the lid can be properly attached to the installation in the stratospheric probe. The data cable needs to be fixed with tape at the slit. The sensor board must also be secured to the outer wall with adhesive

tape. Do not tape over the actual blue sensor board. Tape over the data cable with the result that the sensor board remains free.
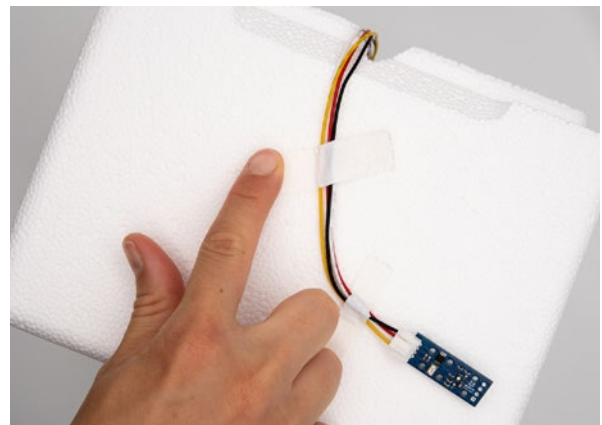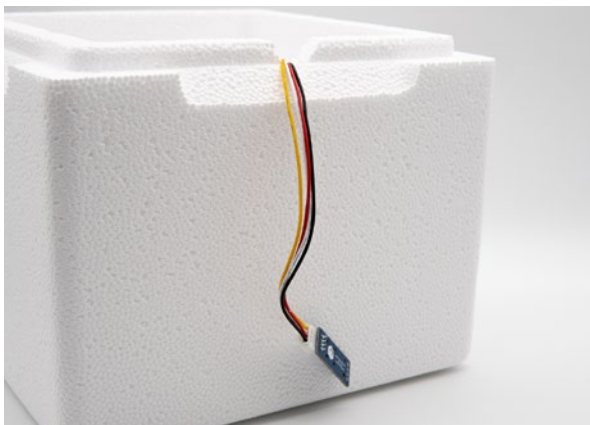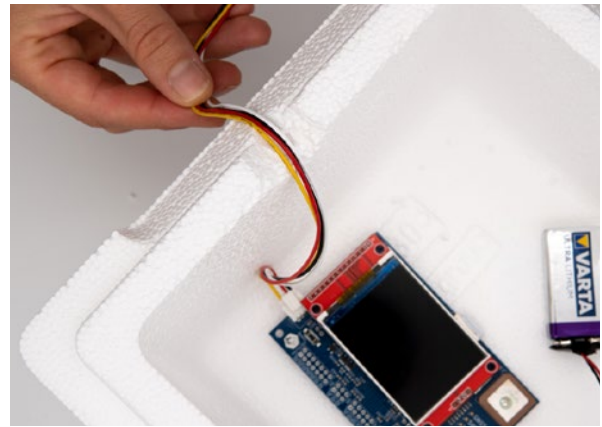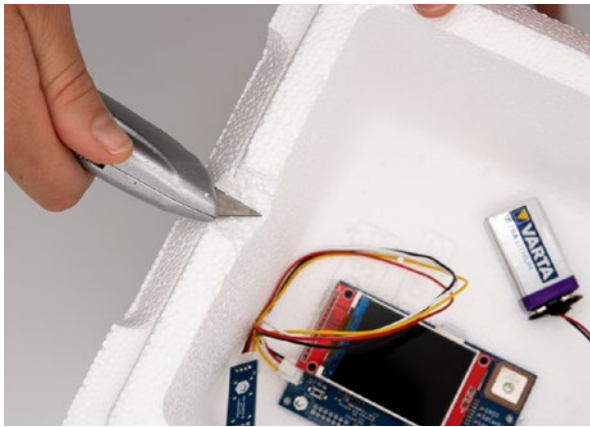
B) Cut a hole in the Polystyrene probe. You need to insert the sensor board through this hole. Pull the sensor board slowly and carefully through the hole in the Polystyrene probe to avoid any damage to the sensitive sensor technology. Tape over your holes (on the inside and outside) which you have drilled carefully in order to prevent cold temperatures inside your probe. The sensor board must also be taped to the outer wall with adhesive tape. Do not tape over the actual blue sensor board but tape over the data cable so that the sensor board remains free.
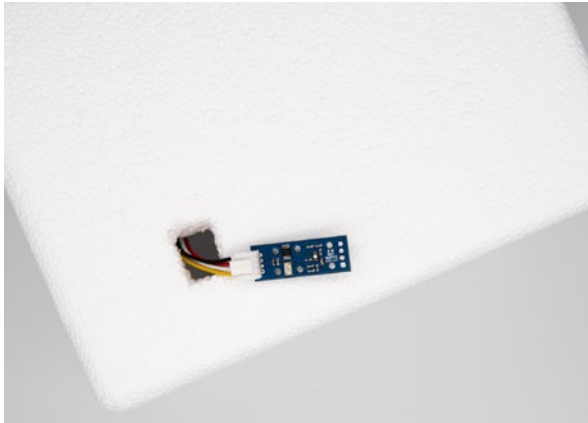
Note: Make sure that the Datalogger do not touch any surfaces or parts of metal, otherwise there is a risk of a short-circuit. Also, the STRATO4 and the sensor board should not come into contact with Water, oil or other liquids.

4 Data analysis

To analyse your collected measuring data of your stratospheric flight, for example, to unravel the secret of the highest altitude reached or the lowest temperature, you need to remove carefully the micro SD card from the card slot of the Datalogger STRATO4. Carefully push the micro SD card in to release it.

Use the SD card adapter, which was also delivered, and carefully insert the micro SD card into the adapter. You have now access to the files stored on the micro SD card via your computer or an SD card reader.

Note: Make sure to save the recordings of your measuring data on the micro SD card immediately before opening or even changing them! Copy your files directly to another storage medium like your computer or a USB stick. Play it safe and save a copy of your data, just in case.

To analyse your data of the flight, you now have various option: For example, you can display the extreme values with help of the Datalogger Evaluation tool and create various graphics of the recorded data. You also have the option to display your measuring data in Google Earth or, for example, to visualise your flight curve with Ayvri.

4.1 Analysing flight data with a tool: Datalogger Evaluation

In order to analyse your measuring data using our Datalogger Evaluation tool, you first have to visit the website www.stratoflights.com. In the section Tutorial, you will find various tools, including the Datalogger Evaluation tool.

https://www.stratoflights.com/en/tutorial/datalogger-evaluation/

On the page "Datalogger Evaluation" you can click on the button "Select file" to select the .csv file from your Datalogger STRATO4. After you have selected the file, the tool automatically uploads the file and makes your measuring data available. Depending on the length of the recorded flight and thus the size of the file and depending on your internet speed, the upload may take a few seconds.

» DATALOGGER EVALUATION MADE EASY «

You can evaluate your datalogger measurements easily with this tool. Simply choose your logfile our tool analyses your data within seconds. It will show the extreme values as well as automatica created graphs. This includes:

- max. altitude
- max. external temperature
- max. internal temperature
- Pressure
- Humidity
- Speed
- Climb-Rate
- ...

Sample file: 3D-Google-Earth-flight-path
Sample log-file from STRATO3

[Datei auswählen] Keine ausgewählt

DATA ARE BEING EVALUATED
●●●●

At the top of the Datalogger Evaluation tool, you will find an overview of the extreme values of your stratospheric flight, such as the highest altitude reached, the highest and lowest indoor and outdoor temperature, maximum speed, etc. This overview gives you a first impression of your mission.

| **Summary**	
max. intern temperature:	24.7 °C
min. intern temperature:	-5.9 °C
max. extern temperature:	28.1 °C
min. extern temperature:	-43.6 °C
max. altitude:	38160.6 m
max. speed over ground:	123.1 km/h
min. pressure:	4.8 hPa
max. humidity (extern):	82.6 %
min. humidity (extern):	0.1 %
max. Light intensity (UVA index):	5.72
max. Light intensity (Infrared):	25165

The Datalogger STRAO4 records every two seconds all parameters. That is why it is possible to analyse the whole flight in great detail and to create very accurate graphics to evaluate your flight. This allows you to correlate all parameters on the x-axis and y-axis.
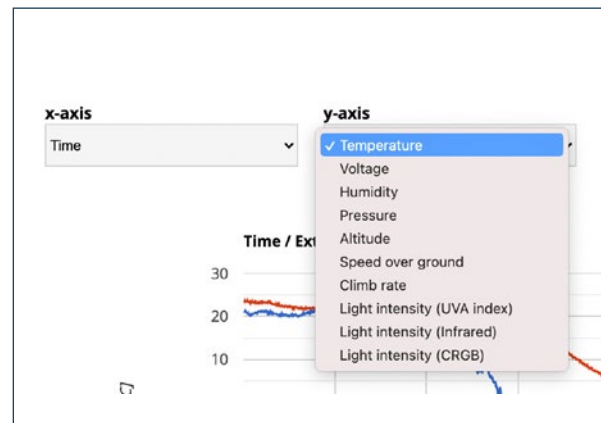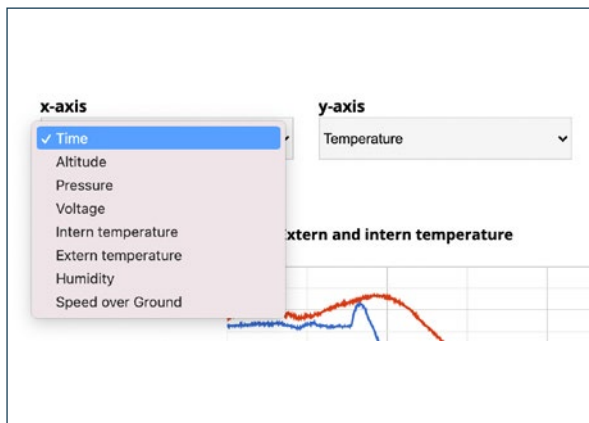
Because of the large number of possibilities of using the Datalogger Evaluation tool, an example of "time" on the x-axis and "height" on the y-axis will be described here to explain one skill of this tool.
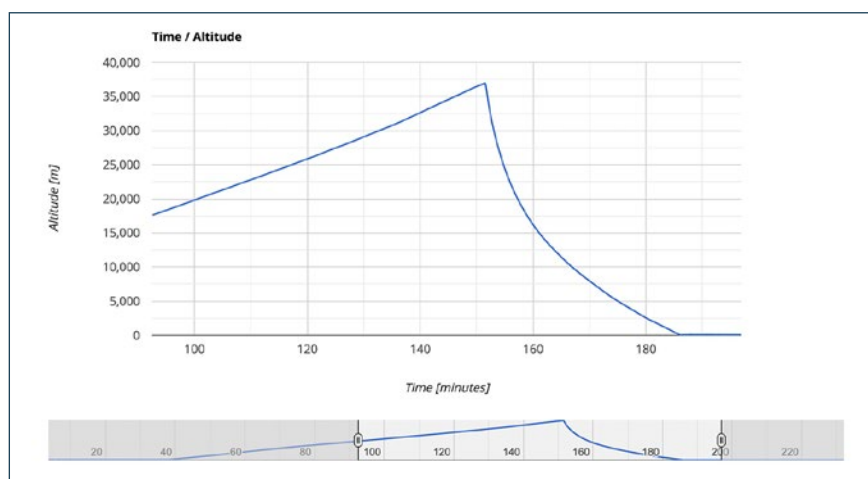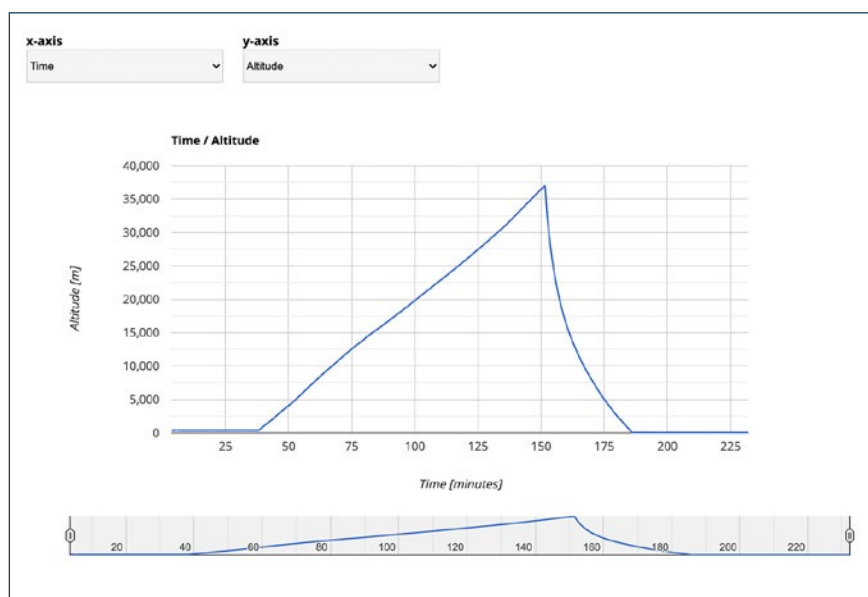
If you select time and altitude on the axis sections, the entire data range will be displayed, beginning from the time when the Datalogger STRATO4 was first switched on to the time it was switched off. The units and the corresponding values are displayed on the individual axis sections. If you look at a specific interval, for example, you can select the interval that you want to analyse in the thumbnail view below with the help of the interval sliders (on the right and left).

You also have the option of saving the selected section as a screenshot (png format) using the „Download" button. The „Reset" button ends the Datalogger Evaluation. The tool offers numerous possibilities to take a closer look at your stratospheric flight and to analyse and visualise it as described in the following chapters.

4.2   Creating flight curves on Google Earth as 2D and 3D visualisation

In order to visualise the flight data of your own stratospheric flight, Google Earth can be consulted to visualise the route of the flight directly on a map, analysing exactly which regions and locations the research probe flew over. The following chapter will explain to you how to create a 2D and 3D flight curve via Google Earth with just a few clicks.

4.2.1   Visualising a 2D flight curve on Google Earth

First upload your file to our converter.

Click on „Select file" to select your file from the Datalogger in order to convert this file into the so-called GPX format. You can find the converter on the page „Datalog-

ger Evaluation" on our homepage below the Datalogger evaluation tool as discussed in the previous chapters.

https://www.stratoflights.com/en/tutorial/datalogger-evaluation/
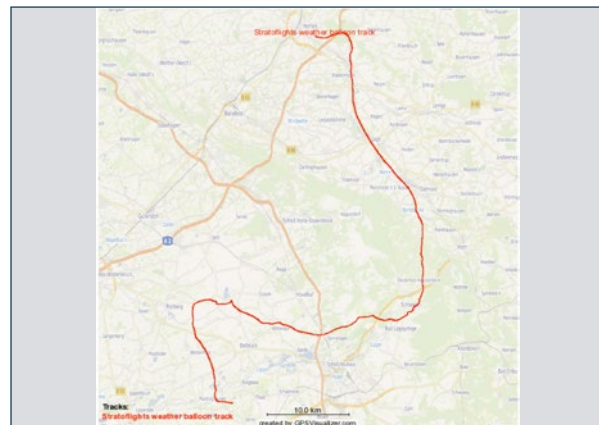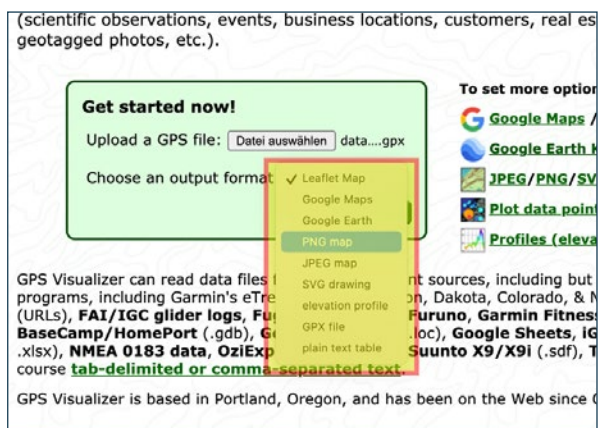
Open now „GPS Visualizer".

https://www.gpsvisualizer.com/

After you have opened the website, you will find in the centre of the page a small box where you can upload the GPX file you have just generated by clicking on „Select file".

Furthermore, you can set the output format, e.g. the creation of a „PNG map" is an easy way to create a 2D flight route from the longitude and latitude saved in the file, as in the following example.

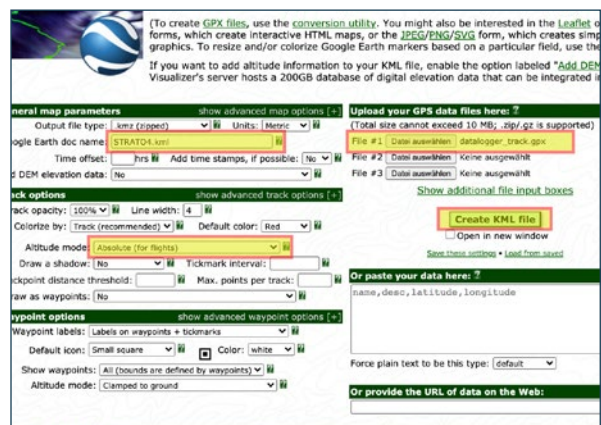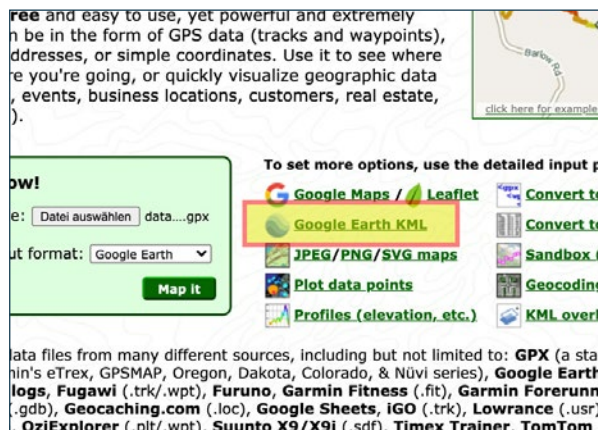# 4.2.2   Visualising a 3D flight curve on Google Earth

To create a 3D flight curve instead of a 2D one you need to convert the .csv file of the Datalogger into a GPX file exactly as described in the previous chapter 4.2.1.

Open now the „GPS Visualizer".

https://www.gpsvisualizer.com/

After opening the website, click on "Google Earth KML".

Now a new page should open which contains a tool. With the help of this tool, you need to make a few adjustments in order to visualise our flight route as a 3D view on Google Earth.

Click on the area called "Browse" on the right-hand side and upload the log file you have previously modified and create a new name for the file. Then select the so-called „Altitude mode" as shown in the illustration above. Select „Absolute (for flights)" now. This way, the tool can also analyse the data of the reached altitude.
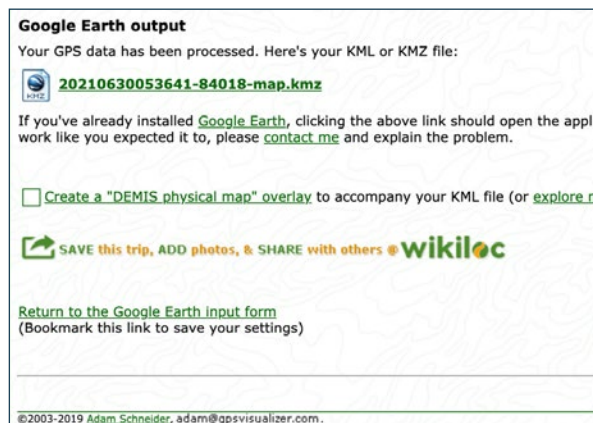
For an application on the ground, an alternative mode can be selected. After these basic settings, click on „Create KML file" and download the file you have created. To display the previously created 3D flight route on Google Earth, you must upload this file to Google Earth. If Google Earth is not installed on your computer, you must download and install it first. Follow this link and you will find the latest versions of Google Earth:

https://www.google.de/intl/de/earth/

After installing Google Earth, click on the file you created. Double-click the file and it opens automatically on Google Earth. Now you can take a closer look at your 3D flight route and inspect it from all perspectives.
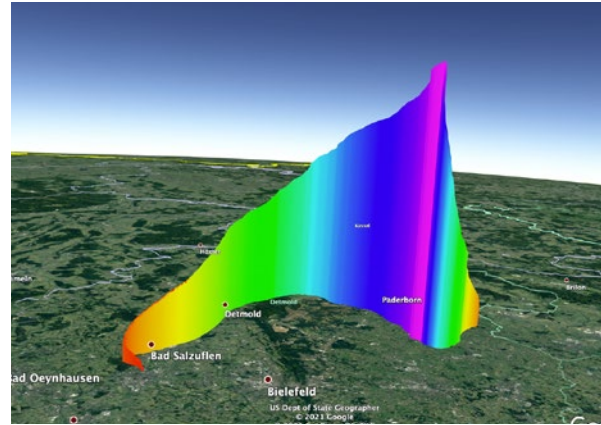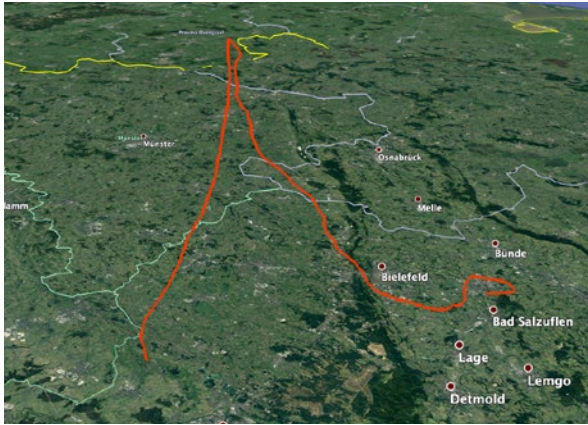
5   UART interface

Almost all of the board's inputs and outputs are labeled, although many pins are not yet in use or are used for internal purposes, e.g. testing.

Usable pins at the bottom are:
3.3V, 5V: Voltage output, can draw up to 700mA
Vin: Voltage measurement with ADC up to 3.3V which is logged
Out: Not used
In: Is pull-up against 3.3V. Can be shortened to log the state (e.g. of a switch)

All other pins are not in use.

In firmware versions above version 2, we implemented experimental support for UART.

The interface is accessible via the USB port (not hardware version 1.4 due to a bug on the pcb), or additionally greater than hardware version 1.3 via the UART interface at the top left below the display. The voltage levels are 3.3 V on all ports. The parameters for the interface are: 115200, 8N1. The logger does not initially send any data, you can request data using the following commands:

{to:'Log',from:'Mst',reci:'headerValsCsv',dir:'g',rc:"}
{to:'Log',from:'Mst',reci:'dataValsCsv',dir:'g',rc:"}

each of which must be completed with a carriage return (Enter key) or newline „\n". With the first command you can get the header and with the second the current data, as with the data on the SD card.

A response can look like this:

{to:'Mst',from:'Log',reci:'headerValsCsv',pl:{headerCsv:'Uptime [s];GNSS: PPS Timestamp [s];GNSS: UTC date time (ISO 8601);GNSS: Fix type (0=no fix, others=fix);GNSS: Latitude [degrees];GNSS: Longitude [degrees];GNSS: Positional dilution of precision;GNSS: Altitude [m] (above Mean Sea Level);GNSS: Ground speed [km/h];GNSS: Satellites in view;GNSS: Altitude [m] (above ellipsoid);Temperature: Board [degC];Temperature: Ext PT1000 1 [degC];Volt: Supply Voltage [V];Volt: 3. 3V board voltage [V];Volt: Vin1 voltage [V];Volt: Vin2 voltage [V];Volt: Vin3 voltage [V];IO: In 1 State;IO: In 1 Timestamp [s];IO: In 2 State;IO: In 2 Timestamp [s];IO: Out 1 State;IO: Out 1 Timestamp [s];IO: Out 2 State;IO: Out 2 Timestamp [s]',},rc:",fnv32:0xda4ebd9b}

or:

{to:'Mst',from:'Log',reci:'dataValsCsv',pl:{tstamp:8138,valsC
sv:'8.137;22.7;23.03;12.51;73.46;-188.68;0.80;5.00;3.41;0.333;0.322;0.393;1;0.000;1;0.000-
;1;8.138;0;8.002',},rc:'',fnv32:0x593d2d45}

The messages are in JSON5 format. The messages can be displayed in a structured manner at https://jsonformatter.org/json5-formatter. Alternatively, there are ready-made parsers for common programming languages.

6 FAQ and solutions

The Datalogger STRATO4 cannot be turned on.
Please check if the power supply is properly connected and if the battery has sufficient energy and is correctly connected. The red LED at GNSS does not stop shining. The Datalogger STRATO4 cannot establish a connection to the satellites. The Datalogger STRATO4 must be operated outdoors with unobstructed line of sight to the open sky! The GPS signal is valid only when the GNSS LED on the STRATO4 board is blinking in green.

Multiple files are stored on the Micro SD card.
Use the most recently created file. It may happen that a new file is created due to a sudden loss of signal to the GPS satellites, for example. Therefore, you should check the recent files. Using the Datalogger STRATO4 analysis tool, you can display the entire flight in a flight curve and verify if the flight has been fully recorded.

The display of the Datalogger STRATO4 turns off after approximately 20 seconds.
This is completely normal and intentionally programmed so that the power-consuming display does not use the majority of battery power. As long as the LEDs continue to shine green, the Datalogger STRATO4 is recording correctly.

I can't open the SD card, or there are no data on it, or the SD card is not working anymore, or the SD card is not recognized.
Use exclusively the 32 GB Micro SD card supplied by Stratoflights! This is very important because this 32 GB Micro SD card enables very high read and write speeds! Therefore, please use the SD card provided by Stratoflights. In all cases we have encountered since the launch of the STRATO4, it turned out during returns that the supplied 32 GB Micro SD card was not used, or it was confused with a supplied Micro SD card from the Space Cam „Apeman."

The SD card LED on the STRATO4 board is blinking in red.
Please insert the Micro SD card or check if it is properly seated in the slot. Once the SdCard LED is blinking in green, data is being written to the Micro SD card.

Which Micro SD cards can the Datalogger STRATO4 read and write to?
The Datalogger STRATO4 can read and write to Micro SD cards up to 64 GB in size. However, it is strongly recommended to use only the supplied 32 GB Micro SD card from Stratoflights. This is crucial because this specific 32 GB Micro SD card provides very high read and write speeds. Please use exclusively the SD card provided by Stratoflights. In all reported cases of issues since the launch of the STRATO4, it

was often discovered during returns that the supplied 32 GB Micro SD card was not used, or it was confused with a Micro SD card from the Space Cam „Apeman." In principle, a Micro SD card up to 64 GB should work.

In which format must the Micro SD card be formatted?
The supplied Micro SD card must be formatted in „FAT32" so that the Datalogger STRATO4 can read and write to the Micro SD card! Use exclusively the supplied 32 GB Micro SD card from Stratoflights! This is very important because this 32 GB Micro SD card enables very high read and write speeds! Therefore, please use the SD card provided by us.

7   Specifications

Maximum height:	**50.000m**
Temperature measuring range Ext.:	**-55°C to + 85°C (-67°F to 185°F)**
Temperature measuring range Int.:	**-40°C to + 85°C (-40°F to 185°F)**
Pressure range:	**10 – 2000 mbar**
Humidity:	**0 – 100%**
Recording rate:	**0,5 Hz**
Power supply:	**5V-12V, battery 9V, USB**
Dimensions:	**100 x 60 x 12 mm (3.9 x 2.4 x 0.5 Inch)**
Weight (without battery):	**approx. 72g (2.5oz)**
Weight (with battery):	**approx. 116g (4.1oz)**

Note: The STRATO4 offers a runtime of approx. 2 days in normal conditions on earth when using a new lithium 9V battery! However, please note that the runtime depends on the load as well as on the extreme conditions of the stratosphere of temperatures down to -65°C.

8 Safety instructions

Please read the safety instructions of this product. Please also read the following safety instructions while preparing and carrying out the flight!

8.1 Signal words

The following signal words are used in this manual:

- **WARNING:** This classifies a hazard of medium risk level. Failure to comply with the warning may result in serious injury.
- **Please note.** This is a warning about possible damage to property.
- **Expert tip:** This is based on our own experience from 10 years and over 1,000 stratospheric flights! Stratoflights does not assume any guarantee or liability for the expert tips mentioned here.

8.2 Proper use

Please read the safety instructions for this the Datalogger STRATO4, hereinafter only referred to as STRATO4, carefully before use in order to be able to deploy it properly. The intended use is to employ the STRATO4 only as described in this manual to measure and record data during a stratospheric flight. If you use it in any other way, this is considered improper use and can lead to damage to property or even personal injury. Please note that the STRATO4 is not a toy for children. In other countries and regions there are different laws on recording measuring data. Stratoflights GmbH & Co. KG is not responsible if such laws or regulations are violated, this is the sole responsibility of the user.

Notice! The manufacturer and dealer accept no liability for damage caused by improper or incorrect use. This is also valid for own developments of the customer or every "extension" or "mechanism" which are connected to the STRATO4 but is not supplied by Stratoflights.

8.3 Safety

WARNING! RISK OF ELECTROCUTION!
A faulty electrical installation or an excessive mains voltage may cause an electric shock.

- Before use, make sure that the mains voltage of the socket corresponds with the information on the type plate.
- If you notice any visible damage to your STRATO4 or the power supply connection or cable, do not use it.
- Use only the original parts supplied to operate the STRATO4. If the power supply connection or the cable of the power supply is damaged, replace it only with original accessories from the manufacturer.
- Never place the STRATO4 near an open fire or hot surfaces or metallic, wet or oily surfaces.
- The STRATO4 is not protected against moisture and water as well as oily surfaces. Therefore, please use and store it only in a dry environment or inside a Polystyrene probe during stratospheric flight.
- The wired power supply of the STRATO4 should also only be used indoors or inside your stratospheric probe. Keep it away from moisture and do not bend it.
- Do not repair it on your own and leave it to qualified specialists. However, if you carry out repairs by yourself, if you connect the STRATO4 improperly or use it incorrectly, liability and warranty claims are excluded.

8.4   Battery mode

WARNING! DANGER OF EXPLOSION and FIRE!
Below you will find information and instructions on how to use the battery:

- The STRATO4 is powered by a lithium 9V battery from VARTA. Follow the safety and operating instructions on the back of any 9V battery supplied.
- Make sure that the STRATO4 is kept away from heat sources and high temperatures, such as direct sunlight in a vehicle.
- If you disregard these instructions, it may result in destruction and overheating of the 9V battery, explosions, and fire.
- Do not burn or pierce the STRATO4. Protect it from mechanical damage.
- Do not remove any parts and attachments from the STRATO4. Do not drop, disassemble, or modify it.
- If a child swallows the 9V Battery from VARTA, seek medical aid immediately!

WARNING! DANGER OF CAUTERIZATION!
Lithium 9V Batteries that leak due to damage may cause burns in contact with the skin. Therefore, never open the 9V Battery. However, if the Lithium 9V Battery leaks, please wear protective gloves.

8.5   Electromagnetic compatibility

Please observe all rules and prohibitions and switch off the STRATO4 immediately in danger areas and if it might cause interference. Furthermore, it should not be used in the vicinity of, for example, medical equipment, fuels and chemicals, or in blasting areas. With mobile devices, malfunction due to interference may occur and affect performance. Transformers and very strong magnetic fields must be avoided. Otherwise, there may be deviations in the recordings of your data. Disregard of these instructions may cause interference or damage of the STRATO4.

8.6   Cleaning

WARNING! RISK OF DAMAGE!
Below you will find information and instructions on how to clean the STRATO4:
- Do not use aggressive cleaning agents or brushes for cleaning. Do not clean the STRATO4 with metallic cleaning objects (e.g. knife, metal sponge). This may damage the surface.
- Never put the STRATO4 in water, in a dishwasher (or the like) and do not use a steam cleaner.

Correct cleaning of the STRATO4:
1. The surface may be wiped clean with a slightly damped cloth.
2. The STRATO4 should then be wiped dry completely and left alone (switched off) for some hours. Also, it should be disconnected from power supply till it is completely dry.

NOTE! Improper handling of the STRATO4 can lead to damage.

8.7   Hazards for children and people in need

Please do not let people (including children) with limited physical, sensory, or mental abilities use the STRATO4. It is considered an exception if they have previously received instructions from a person responsible for their safety on how to use the device. Please be sure that they do not play with small parts (e.g. accessories, etc.). These may be swallowed, leading to suffocation. Inform your child about the dangers and about how to use the STRATO4. The STRATO4 is not a toy.

8.8   Storage

If you do not use the STRATO4 for some time, turn it off, remove the cable for power supply and disconnect the Lithium 9V Battery. Place the STRATO4 in its original packaging or in a carton of the same size. Protect the STRATO4 from dirt and humidity. Keep out of the reach of children.

8.9   Declaration of conformity

Stratoflights GmbH & Co. KG hereby declares that the radio equipment type Logger, model STRATO4, complies with Directive 2014/53/EU. The full text of the EU Declaration of Conformity is available at: **www.stratoflights.com/konformitaetserklaerung/**

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8.10   Disposal of packiging

Dispose of the packaging according to type. Add cardboard to the paper bank, plastics to the recyclables collection.

8.10.1   Acceptance of returned used batteries free of charge

Batteries must not be disposed of with household waste. You are legally obliged to return used batteries so that proper disposal can be guaranteed. You can dispose of used batteries at a municipal collection point or at a local retailer. As a distributor of batteries, we are also obliged to take back used batteries, whereby our obligation to take back only applies to the type of used batteries that we have or had as new batteries in our range. Used batteries of the above type can therefore either be returned to us with sufficient prepayment or directly to our shipping warehouse at the following address free of charge:

Stratoflights GmbH & Co. KG
Saulsiek 17
32825 Blomberg
Deutschland
E-Mail: **info@stratoflights.com**

8.10.2   Separate collection of old appliances

Electrical and electronic equipment that has become waste is referred to as old appliances. Owners of WEEE must have it collected separately from unsorted municipal waste. In particular, old appliances must not be disposed of with household waste, but in special collection and return systems.

8.10.3   Batteries and accumulators

Owners of WEEE must normally separate used batteries and accumulators which are not enclosed by the WEEE from WEEE before returning them to a collection point. This does not apply if the old appliances are handed over to public waste management authorities and separated from other old appliances for the purpose of preparation for reuse.

8.10.4   Return options for old appliances

Owners of WEEE from private households can hand it in at the collection points of the public disposal authorities or at the collection points set up by manufacturers or distributors within the meaning of the ElektroG. An online list of collection and return points can be found here: **https://www.ear-system.de/**

8.10.5   Data protection notice

WEEE often contains sensitive personal data. This applies in particular to information and telecommunications technology devices such as computers and smartphones. In your own interest, please note that each end user is responsible for deleting the data on the old devices to be disposed of.

8.10.6   Manufacturer registration number

As a manufacturer in the sense of the ElektroG we are registered at the responsible foundation Elektro-Altgeräte Register (Nordostpark 72, 90411 Nürnberg) under the following registration number: DE74539658.

Do you have any questions?

Just contact us,
we are happy to help you!

Stratoflights GmbH & Co. KG
Saulsiek 17
32825 Blomberg
Germany
Mail: **info@stratoflights.com**
Telefon: +49(0)171/7542510
Web: **www.stratoflights.com**

Best regards
your Stratoflights-Team

8.11   General notes about a stratospheric flight

Stratoflights GmbH & Co. KG guarantees and assumes no liability for the correctness of the information provided here as well as on all manuals, platforms, websites etc. related to Stratoflights. KG.

- **Ascent permit:** Please note that the ascent of a Weather Balloon and thus the execution of your stratospheric mission must be registered by the authorities and that you are personally liable for the ascent of your weather balloon! Where and how and what information you need to register in your country your Weather Balloon can be found on our homepage by clicking on the following link. Detailed information on this subject can be found in the **manual**.
- **Aviation liability insurance:** Please note that the ascent of a Weather Balloon must be insured in most countries. You can find more information about this topic on our homepage by clicking on the following **link** or in the **manual**.

9   Checklist: Perfectly prepared and thought of everything?

Here's what you need for a successful stratospheric mission:

☐		**Flight permit**	In order to launch your weather balloon, you need a flight permit in your country. You can find some basic information about different countries on our websie. →
☐		**Batterypack**	In temperatures as low as -65°C, the camera's internal battery will not last for the entire flight time. You will need a batterypack so that your entire stratospheric flight can be filmed. →
☐		**Parachute 800**	To make sure your payload floats gently and safely back to earth, you need a parachute. The 800 parachute is designed for payloads up to 800g. →
		Parachute 2500	For larger payloads you need a larger parachute. The 2500 parachute is ideal for payloads between 800-2,500g. →
☐		**Helium pressure reducer**	To fill the calculated amount of helium/ balloon gas into your weather balloon, you need a pressure reducer for helium. This allows you to get the right lift for your balloon. →
☐		**Suitable launch site**	Launch sites such as meadows, parks or your own property are perfect. Make sure there is enough space so that the balloon will hit no obstacles. →
☐		**GPS Tracker STRATOfinder**	The GPS tracker transmits the exact landing position. A commercially available prepaid SIM card is required. →

☐		**Gloves**	To avoid „damaging" the sensitive envelope of the weather balloon, all team members working on the weather balloon should wear gloves and take off rings, earrings, etc. Please avoid contact with the ground!	➡
☐		**Helium/ Balloon Gas**	Gas creates the lift. This is available from gas dealers in your region or larger DIY stores / Hardware stores. You can use our helium calculator in the tutorial/ Stratoflights app for the calculation of the correct amount you need.	➡
☐		**Aviation liability insurance**	For the flight permit you need an aviation owner's liability insurance. You will find information on this in our tutorial or ask a local insurance agent for the specifications in your county.	➡
☐		**How to launch a Weather Balloon**	On almost 100 pages with numerous pictures and expert tips, this manual will guide you through the full process of a stratoflight.	➡
☐		**Space Cam „Apeman"**	Reliable camera for extreme conditions. Many cameras and actioncams from well-known manufacturers have problems in the harsh stratospheric conditions. The Space Cam is reliable and delivers great images.	➡
☐		**Special cord**	Most countries in the EU require a maximum tensile strength of 230N according to the SERA Law, which is the legal basis for weather balloon ascents in Europe. Our special cord fulfils these criteria of the authorities.	➡
☐		**Polystyrene probe**	Your equipment needs to be protected from the extreme conditions to avoid failures. The styrofoam probe offers enough space and protects your equipment against the extreme temperatures of up to -65°C.	➡
☐		**Tesa duct tape**	To seal your probe as well as your weather balloon, you need reliable tape. Tesa duct tape is perfect for this purpose.	➡

☐		**Backup-GPS Tracker**	As a backup GPS tracker, a second STRATOfinder or SPOT Trace may be useful to provide maximum security.	➡
☐		**SPOT Trace**	If a live position is desired or a landing at sea is not unlikely, the GPS tracker SPOT Trace is the perfect choice for a successful stratospheric flight.	➡
☐		**Datalogger STRATO4**	In addition to the GPS position, altitude and speed, the STRATO4 also records temperature, air pressure, humidity and much more in order to completely analyse the stratospheric flight.	➡
☐		**Teaching unit: Stratosphere flight**	A lesson series especially for the stratosphere! Task and solution sheets for 11 double lessons, valuable info for preparation and assistance in every phase of a school project.	➡

☐		**Cutter knife/ scissors**	Useful tools to prepare your probe and carefully open the box for the weather balloon.	➡
☐		**Spanner for pressure reducer**	The gas bottle for the helium/ balloon gas is screwed on with a cap. The cylinder pressure reducer for helium must also be attached.	➡
☐		**Side cutter**	Useful to remove the excess of the cable tie.	➡
☐		**Stratoflights app**	The App is a helpful tool in your pocket: have checklist, all tools and information ready to hand at the launch site!	➡

10   About Stratoflights

We hope that we have been able to help you with this instruction of the STRATO4 as well as with our other free services such as the Stratoflights App, the tutorials, and videos on our website. We hope that you will experience an extraordinary adventure with sensational shots of our planet.

We are always happy to receive suggestions, constructive feedback, and reviews of our products in our online shop. We would like to use this opportunity to point out that this project is perfect to be carried out by students/pupils in school, hence all scientific disciplines are involved in this project. The students are not only introduced to scientific knowledge and to take this knowledge into action, but rather experience a learning adventure though a stratospheric flight.

We thank you again for trusting us and our product! We would be very pleased if you recommend this project to others.

Your Stratoflights team

Follow us on Instagram, Facebook and YouTube
and tag us on your project!

www.stratoflights.com