NGA ANALYSER – GPS DATA PROCESSING SOFTWARE

Contents

Added:

- SMS-GPS automatic data downloading and processing,
- Compatibility with csv files from Ecotone Telemetry web panel.

Changes & improvements:
- Faster engine for maps processing,
- New data plots added
- Export & import of plot settings improved,
- Minor bug fixes and improvements stability.

Introduction to NGA Analyser

The NGA Analyser is our new software package which replaces previously used GPS Analyser.

This package allows simultaneous download and preview of multiple files of raw data from loggers which came via UHF link and have been transmitted by GPRS/3G to the FTP server as well data transmitted via SMS-es. Fast data evaluation on plots supports defection of possible configuration problems and helps to optimise settings of your loggers.

From existing data NGA calculates additional parameters like travel speed, distance between positions on ellipsoid model, computes and calibrates to water level the diving depth, uses multiparameter algorithm to calculate altitude, as well exports downloaded data to csv or kmz formats.

In near future, the NGA will gain additional modules with statistical instruments, more mapping options, exports to Movebank format as well more advanced data processing tools.

Program installation:

The NGA Analyser is incorporated into GPS Tracker software package and starts automatically after downloading data from base station.
The NGA can be also used as a separate program to process data from the Web panel or data saved in your PC.
- Download the NGA launcher from: http://nga.gps.ecotone.pl/ngaupdates/NGAnalyzerSetupComplete.exe
- Go to downloaded files and run it - installation process will start automatically.
- The program icon will be installed in the Start Menu in Ecotone Telemetry folder, for easier further operating it is suggested to create a shortcut on the desktop or pin the shortcut to the Task bar.
- Each time when NGA starts, it checks if new version is available. When the internet connection is not present, program starts anyway.

Some antivirus programs, as well Windows defender, may prevent download or installation the NGA package. In such case disable protection for a while or add an exception to NGA.

System requirements
- .Net Framework 4.6.1
- 64-bit operating system
- Windows 7 or newer
- 2GB of RAM - Application itself requires about 150 Mb to run and about 500 MB in total to work with typical files – however loading big data sets may require much more memory (for every 50 MB in raw data additional ~2.5GB of RAM may be required)
- Display resolution 1366 x 768

Recommended:
- 4 Core CPU

- DirectX11 capable graphic card (for fast and responsive charts)
- 8 GB of RAM or more
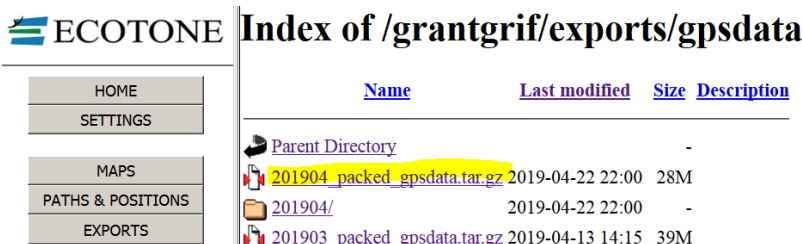- HD Display resolution (1920 x 1080)

Data files access:

All data downloaded from loggers are saved in .txt format. Data downloaded via UHF link are already converted from binary format by base station, however data transmitted to FTP server do not come thru base station and stay in binary format. Both kinds of txt files are called raw data.

- Files can be opened from menu **File** (Open Txt) or dragged to the program window.
- Program opens .txt files downloaded from the base station or files already downloaded from FTP to your PC.
- Files from the FTP do not require a conversion from binary format, NGA program converts them itself.
- It allows you to open multiple files in .txt format at the same time, files can be also mixed – simultaneously from FTP and base station, however before they must be saved in the same folder.
- The .txt file name from the base station has a timestamp generated while the base station memory has been erased, e.g. 20190311224501.txt and such file can contain data from many loggers.
  The file name from FTP has at the beginning logger phone number (e.g. 534610424) and the timestamp generated when the file was prepared for transmission via GPRS, e.g. 534610424_D190311060509.txt. The single FTP file contains always data from one logger.
- From NGA version 2024-02-15, it is also possible to process .csv files generated by the telemetry Web Panel and containing GPS data sent via SMS.

Open TXT

- Open menu **File** and select Open Txt;
- The file explorer will open last used folder;
- Select single file or multiple files with Ctrl+LMC (*Left* Mouse *Click),* Shift+LMC or select all with Ctrl+A;
- Opening will be indicated by the progress bar;
- Opening time depends on the file size and your PC parameters, mainly the RAM resources. When opening time is very long or progress bar will be stopped, close the program and try again but this time select less files for processing. This problem appears only when really large number of files have been selected from the FTP folder, in such case it is recommended to select monthly data from one or from only a few loggers only.
- The FTP data called also a Web panel data, can be downloaded with File/OpenWeb from NGA menu or downloaded manually from your Web telemetry profile as a zipped folders. They are available from menu **EXPORTS/GPSDATA**:
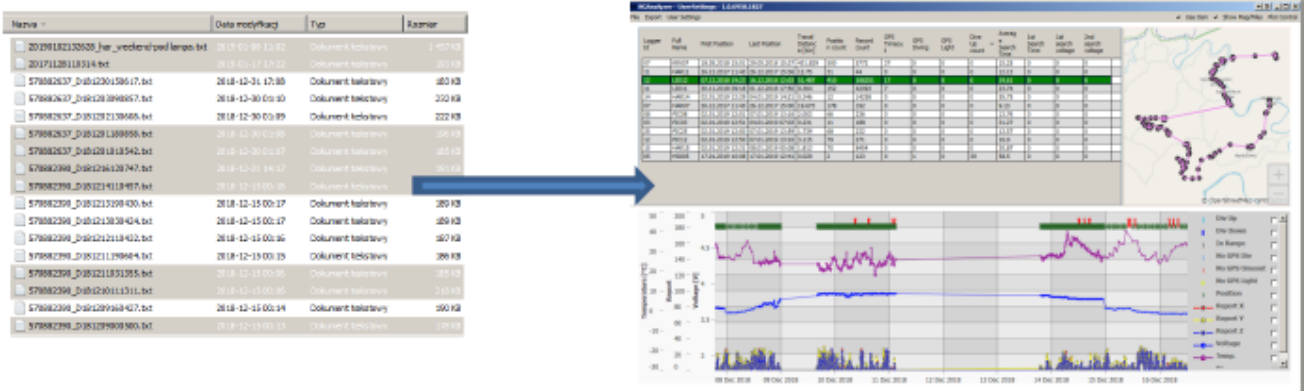
Dragging files:

- Open folder where the data files are stored;
- Select single file or multiple files with Ctrl+LMC (*Left* Mouse *Click),* Shift+LMC or select all with Ctrl+A;
- Drag selected files to NGA window;

- When it's necessary to open all data from one or more folders, just drag selected folders to the NGA window.

Open Csv

- The .csv files can be opened from menu File (Open Csv) or dragged as well but always only a single file can be opened. Program accepts any .csv files which have been previously generated by NGA, or older ones, generated by Logger Analyser.
- The .csv files generated by NGA can be user processed, filtered, cleared unwanted data e.g. from testing period etc. but they must be saved again in the same format and with unchanged structure of columns. Custom's columns can be added only after the last column used by the system.
- It is also possible to open converted data from any source but the csv format and unchanged names of 14 first columns till "Altitude", must be preserved.

Open Web

The NGA allows automatic data download which come from the FTP server, associated with your telemetry Web Panel and combining them with data received by SMS-es. With one click you can easily download all data files and store them at your PC or synchronise them with already saved files. The internet connection is necessary to use this function.

- Open menu File and select Open Web;
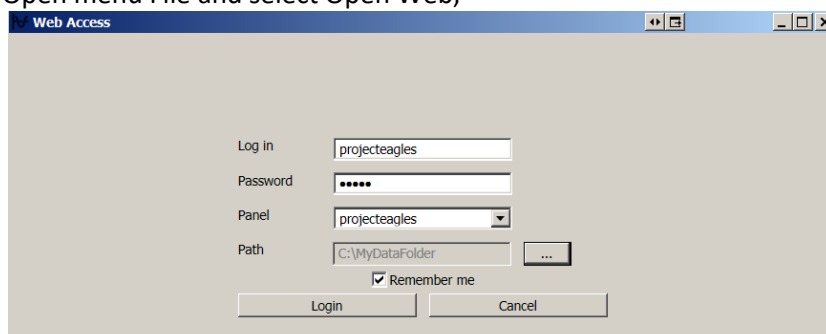
- Use login, password and your Web panel name;
- Choose or create folder for GPS data. The subfolder with the panel name will be created automatically. When you use more than one Web panel, folders for each panel will be created.

- Click Login;

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- First data download can take a few minutes, depending on the amount of data stored on the FTP server and your connection speed. Further downloads will be much faster because only new or changed files will be synchronised;
- After downloading data from the Web panel, the new window (presenting collected data) will be opened;
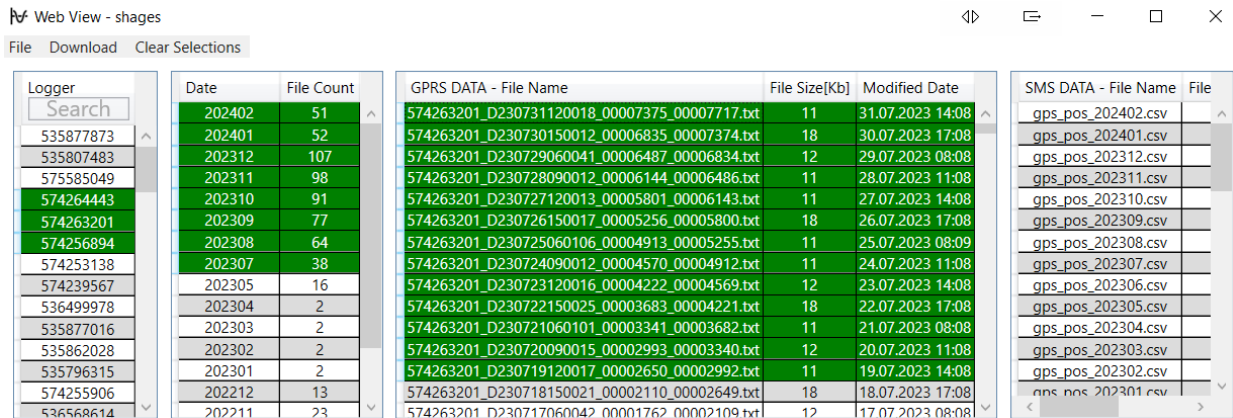
- Choose the logger (identified by the phone number) or several loggers with Ctrl+LMC (Left Mouse Click), Shift+LMC or select all with Ctrl+A, and analogously make selection of stored data in a month, GPRS DATA and SMS DATA columns. The SMS data may be not selected while "Auto attach sms data" was checked. When some data ranges have been selected by the mistake, use "Clear Selections" button.
- Choose one of the options from Download menu;

Download menu
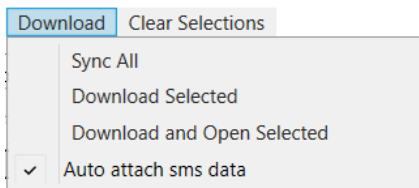
- Sync All – this function synchronizes all data from the Web panel with local folders. The selection of loggers Id or data range is not needed. It's not commonly used function but useful when you plan to process data off-line.
- Download Selected – downloads and synchronizes with local data only selected loggers and only chosen data ranges. It's also not commonly used function but useful when you plan to process selected data off-line.
- Download and Open Selected – synchronises data with local folders and opens data plots in NGA window.
- Auto attach sms data – when the box is checked, NGA will open only GPS-SMS data associated with chosen loggers (identified by the phone number). The SMS data may be not selected while "Auto attach sms data" was checked, all SMS data will be processed anyway. When the selection is done, only SMS data from chosen files (period) will be processed.

All downloaded data will be stored in folder chosen in menu Open Web e.g. MyDataFolder, and then in nested folders as: MyDataFolder/Web panel name/Logger phone number/Month/raw data files.
The downloaded data - even stored in nested folders - can be opened by dragging one or more folders to the NGA window.
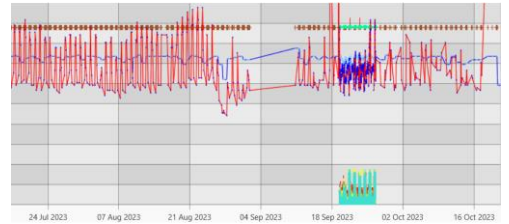
SMS data selection

When downloading with **enabled** "Auto attach sms data" function, minimum one GPRS DATA file has to be selected.

- "Auto attach sms data" **enabled** & no one SMS DATA file selected – selected GPRS DATA & the whole range of SMS DATA for chosen loggers was processed.
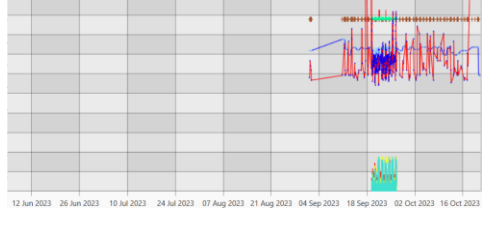
- "Auto attach sms data" **enabled** & a particular SMS DATA range selected – selected GPRS DATA & selected range of SMS DATA for **chosen** loggers was processed.

- "Auto attach sms data" **disabled** & a particular SMS DATA range selected – no GPRS DATA & selected range of SMS DATA for **all** loggers was processed.

- "Auto attach sms data" **disabled** & a particular SMS DATA range selected – selected GPRSDATA for chosen loggers & selected range of SMS DATA for **all** loggers was processed.

Functions:

The NGA screen is divided into three basic panels: loggers list, map window & chart window.

Loggers list

- All loggers from downloaded data are shown here, the identification of displayed loggers is based only on the ID, which is used in the same format, also in loggers without GSM communication. The phone numbers are not shown;
- In columns are shown some basic parameters which describe collected data from each logger;
- All columns can be sorted by clicking on the column headers.

Map window

- The NGA uses OpenStreetMap (OSM) for fast previewing GPS data. The internet connection is necessary to use the map, but recently previewed places are buffered by the program. To use the OSM map in places without the internet access, preview your region of interest in advance, zoom it in and out to buffer all layers;
- To stay only on schematic World map, uncheck the "Use Osm" from the top bar menu:
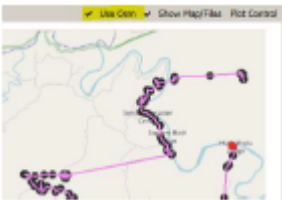
- Use mouse left button to move the map and scroll to zoom in or out;
- If necessary, adjust the size of the map window by moving the borders of plot or logger's list windows:
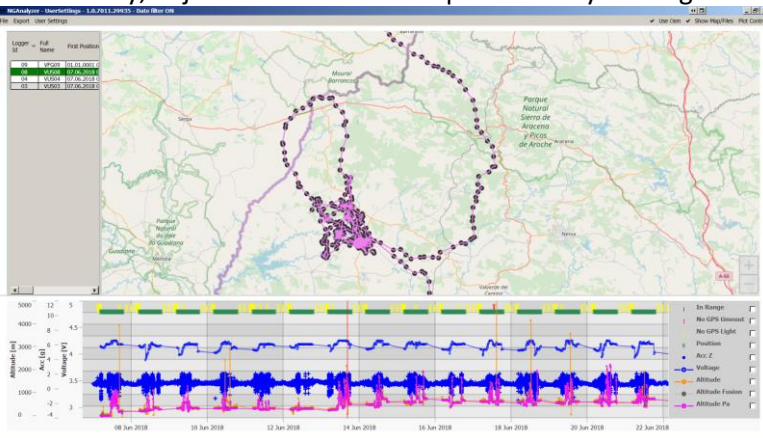
- To reset zoom and come back to full GPS track preview, double clik on the map with the mouse scroll button;

- It is possible to localize on the data plot any point from the map - just place cursor on the GPS point on the map and use Ctrl + left mouse click. It will mark by red line the parallel point on the data plot in the chart window with vertical red line.
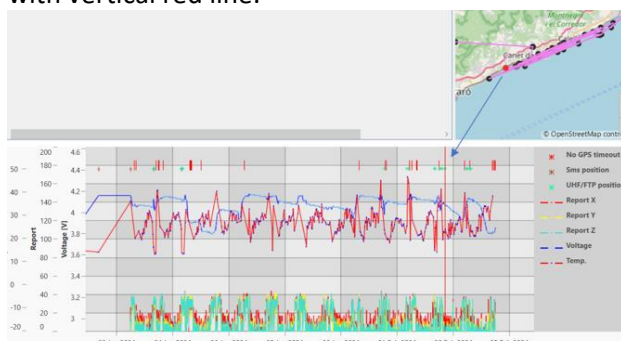
- It is also possible to follow on the map animal movements from the data plot - keep pressed Ctrl and place and move cursor on the plot. The cursor position will be marked by red dot on the map.
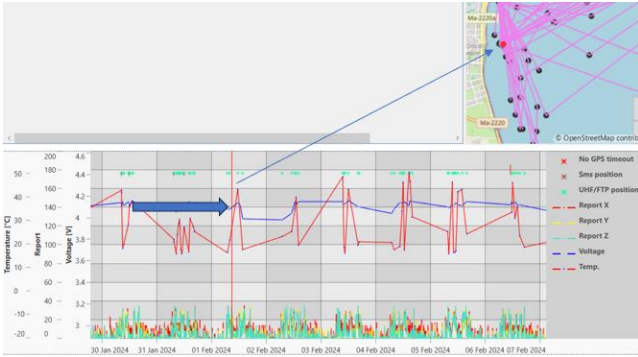
Map menu

- When working offline and when the OSM map hasn't been not cached, uncheck "Use OSM" to work on very simplified contour World map.
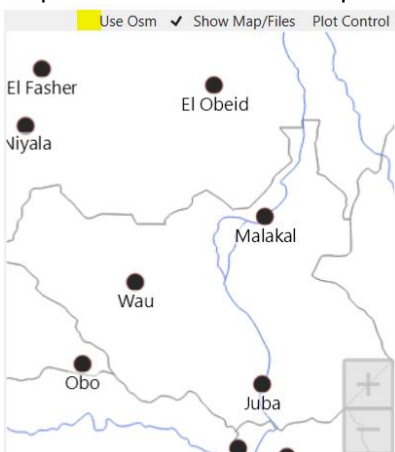
- To verify what files are currently used for analyses, uncheck "Show Map/Files". When unchecked, a list of files will be presented. It is useful to check which files are already displayed, especially when user has a plenty of data files in many different folders:

Chart window

NGA displays all collected data types, logger operational parameters as well some values which are calculated from recorded data, e.g. diving depth or corrected altitude. Plots allow fast data evaluation, finding gaps, detecting interesting or important events as well helps to take decision about changing logger settings.

Plot Control Menu

Check boxes to activate data series to be displayed on the chart.
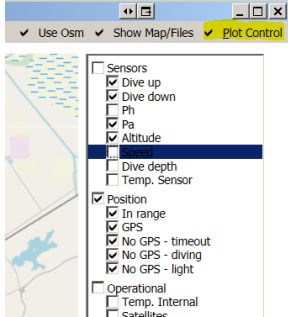
- Color/Size settings – enables adjustment of the chart to your own needs. Check boxes at the bottom of the Plot Control menu to enable this function.
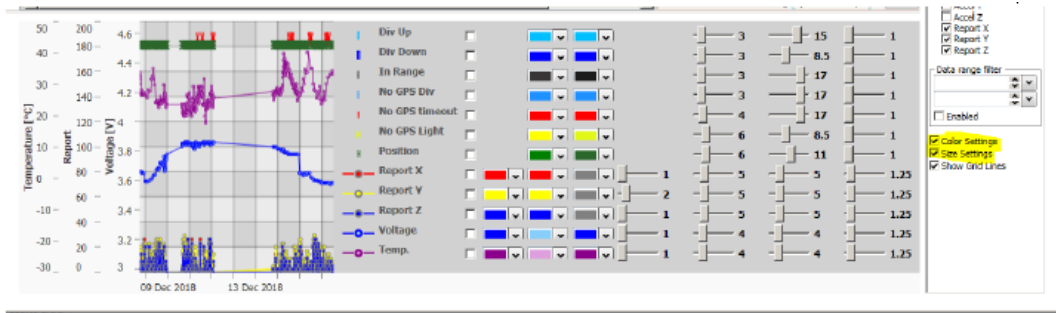
- In case of data series with enabled lines between points, the line can be turned off by the use of transparent colour:
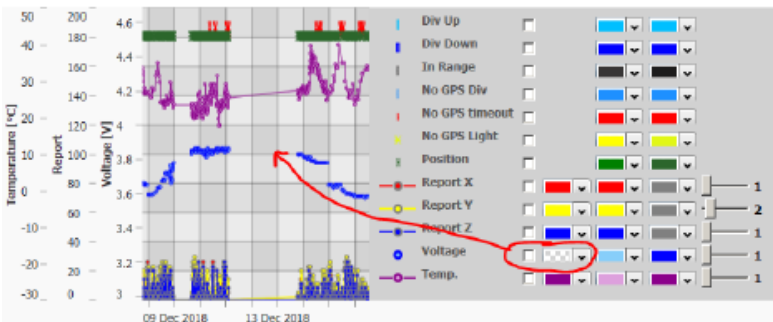
- Switch between the chart view without or with grid lines by checking the box in the **Plot Control** menu.

or

User Settings menu.

User-defined settings for the chart as well as set of displayed types of data can be saved as a default from menu User Settings (Save As Default) to be applied always when NGA program starts. User can create many profiles for different types of data or loggers, save them with 'Save As' and activate with the command 'Load'.
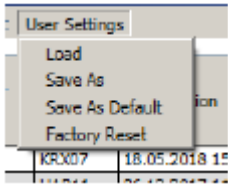
Plot controls.

- Roll: scaling of the time axis.
- Double click on the blank part of the graph – restores full time scale and recalibrates ranges of all plots.
- Clicking on the series plot displays labels with the data (with Ctrl marks several graphs) or the same result by checking boxes in the legend. Clicking on the chart field (but not on the series plot) clears previous selection.
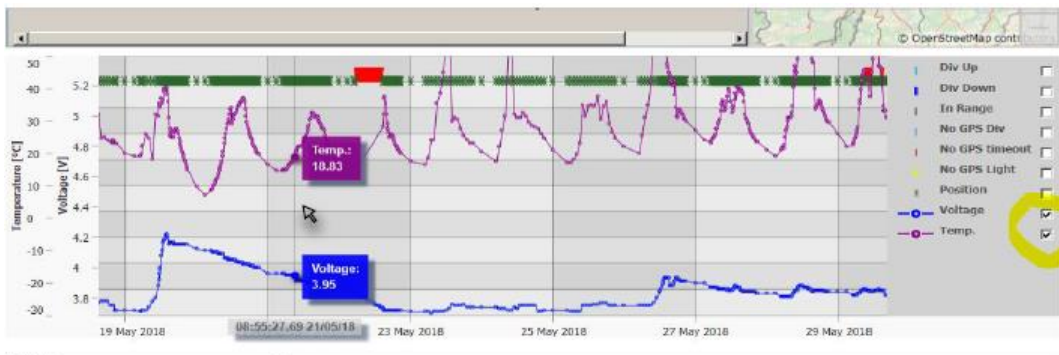
- Left mouse key + cursor on the vertical axis: moving unlocked axes.
- Right mouse key + cursor on the vertical axis: scaling range of chosen axis, applicable only to series with unlocked ranges.
- Ctrl + cursor: move the cursor horizontally on the chart to mark corresponding GPS position on the map (red dot). The vertical line on the plot shows selected GPS position on the timeline.
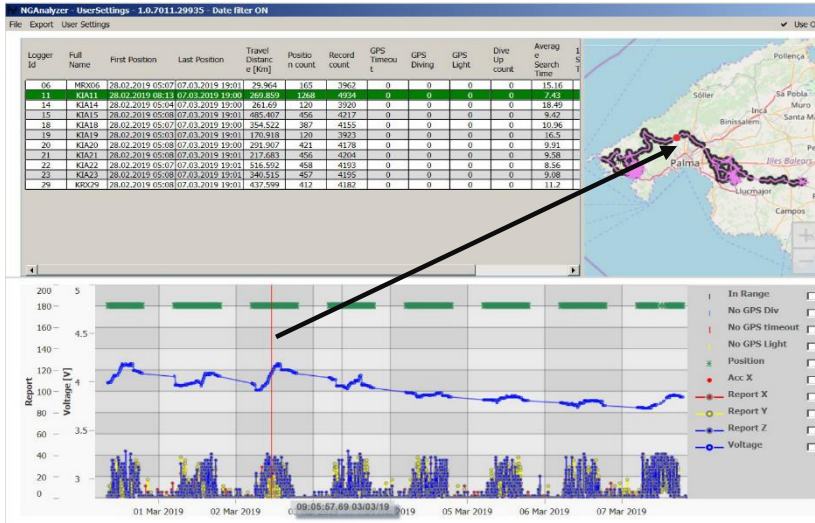
- Chart display order - In case of overlapping charts, you can decide which of them will be visible by checking the box in the legend panel.
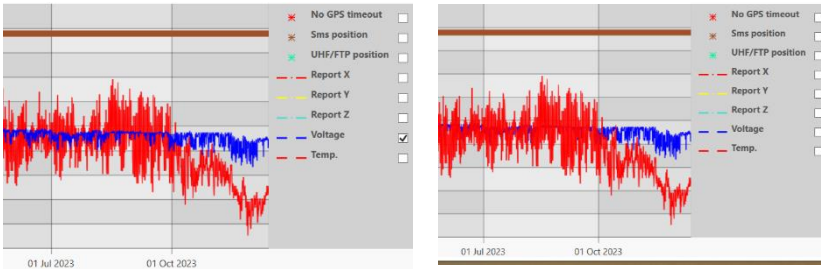
Date filter

The date filter enables excluding unwanted data e.g. from testing period or to preview and analyse data from selected period. When mentioned filter is enabled, it is effective to all loggers from the list. It changes values displayed in the loggers tab like number of collected positions, dives as well calculations of the travel distance or TTF. All plots as well maps show only data from selected period.

Moreover, exported files in csv or kmz format contain also only data from filtered range. To avoid mistakes, the NGA automatically adds to the file name information about used filter range. For example, file names without filtering are: KIA19.csv or KIA19.kmz and with filter enabled: KIA19_filtered_20190228-20190308.csv or KIA19_filtered_20190301-20190307.kmz. However the filter allows to set also time in hours, but in the automatically generated file names, only dates will be shown.

Filter is available from menu Plot Control. After selecting the dates range and if necessary - time, enables filtering by checking the box "Enabled".

The Reset button clears all filters and restores current date in filter menu.
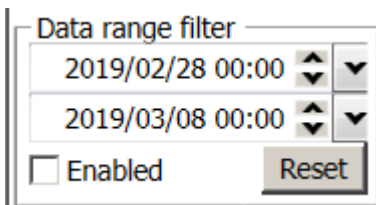
When date filter is active, it is indicated in the top bar.

Data exports

NGA allows to convert and export downloaded data to csv and kmz format. The csv files can be opened with any further software. The kmz files are in Google Earth format. Except the GPS positions they show also altitude when it is collected by loggers. Tilt the view in Google Earth to see the altitude visualisation.

When data filter is active - it affects exported data range (see chapter Date filter).
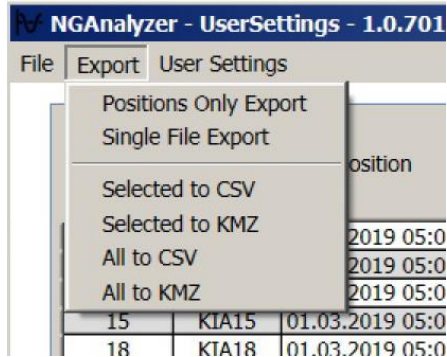
- Positions Only Export – when checked, functions All to CSV or Selected to CSV exports in csv files only the GPS data. It does not affect export to kmz format.
- Single File Export – when checked, functions All to CSV and All to KMZ export data from all loggers to one file. When unchecked, each logger data will be saved in a separate file, it helps a lot, especially when data sets from many loggers together are too big to be opened with other programs.
- Selected to CSV – exports data to single csv file from only one logger, which is currently previewed.
- Selected to KMZ – exports data to single kmz file from only one logger, which is currently previewed.
- All to CSV and All to KMZ export all data respectively to csv or kmz files.

CSV file structure

no.	column header	sample	type	format	unit	description
1	Logger ID	ABC12	string	ABC12	na	Loggers ID used in UHF or GPRS transmission
2	Year	2018	integer	1234	na	Year
3	Month	02	integer	12	na	Month
4	Day	15	integer	12	na	Day
5	Hour	14	integer	12	na	Hour in UTC, range 00-23
6	Minute	35	integer	12	na	Minute, range 0-59
7	Second	22	integer	12	na	Second, range 00-59
8	Latitude	54.490299	decimal	123.456789	degree.	WGS84 Datum
9	Longitude	18.531999	decimal	123.456789	degree	WGS84 Datum
10	Speed	12.4	decimal	1.23	knot [kn]	knot = one nautical mile (1.852 km) per hour, approximately 1.151 mph
11	Searching time	12	integer	123	second [s]	usually called as TTF (Time to fix)
12	Voltage	3.15	decimal	1.2	Volt [V]	battery voltage during work
13	Temperature	35.3	decimal	12.3	Celsius degree [ºC]	integrated sensor on pcb
14	Altitude	123	integer	1234	meters [m]	GPS estimated altitude above the reference ellipsoid
15	Div up	1	integer	1	na	1 marks end of dive
16	Div down	1	integer	1	na	1 marks beginning of dive
17	No GPS - timeout	1	integer	1	na	1 marks lack of GPS position caused by time-out over the limit.
18	No GPS - diving	1	integer	1	na	1 marks lack of GPS position caused by diving detection.
19	In range	1	integer	1	na	1 marks recorded presence in base station range.
20	Diving duration	00:00:04	time	hh:mm:ss	time	time calculated between beginning and end of one dive
21	Raw Latitude	5429418	combined	DDD MM.MMM	degree	WGS84 Datum

22	Raw Longitude	1831920	combined	DDD MM.MMM	degree	WGS84 Datum
23	Decision Voltage	3.15	decimal	1.2	Volt [V]	battery voltage during idle time
24	Millisecond	980	integer	123	millisecond [ms]	used for accelerometer data, range 0-980, resolution 20 ms
25	Acc_X	-0.06	decimal	1.23	0.01G [G]	1G=9.81m/s², range: -2G to +2G, resolution: 0.01G
26	Acc_Y	0.05	decimal	1.23	0.01G [G]	1G=9.81m/s², range: -2G to +2G, resolution: 0.01G
27	Acc_Z	-0.99	decimal	1.23	0.01G [G]	1G=9.81m/s², range: -2G to +2G, resolution: 0.01G
28	PA	998	integer	123456	millibar [mBar]	Atmospheric pressure
29	PH	1150	integer	123456	millibar [mBar]	Hydrostatic pressure
30	Depth	34.5	decimal	1234	centimetre [cm]	Depth calculated from hydrostatic pressure, water surface level calibrated to atmospheric pressure.
31	Temp_sens	35.35	decimal	12.34	Celsius degree [°C]	separate sensor build in housing wall (pressure and temperature sensor)
32	Activity_X	12	integer	12	na	activity index based on accelerometer readings - explanation in appendix
33	Activity_Y	7	integer	12	na	activity index based on accelerometer readings - explanation in appendix
34	Activity_Z	14	integer	12	na	activity index based on accelerometer readings - explanation in appendix
35	Date_2	2018-12-22 13:51	time	YYYY-MM-DD hh:mm	na	date and time as a string - represents the same time as above
36	PDOP	01.40	decimal	12.34	na	Geometric or Position (3D) dilution of precision (GDOP or PDOP – 3D)
37	HDOP	01.05	decimal	12.34	na	Horizontal dilution of precision (HDOP)
38	VDOP	00.92	decimal	12.34	na	Vertical dilution of precision (VDOP)
39	Heading	146	integer	123	degree	GNSS heading: pointing direction with respect to true north on the horizontal plane
40	Sat. Count	12	integer	12	na	Number of satellites used for calculations, range 1-12
41	No Gps - Light	1	integer	1	na	1 marks lack of GPS position caused by light sensor
42	Additive Vincentys Distance[Km]	0.005	decimal	12.34	kilometre [km]	additive distance from first GPS position in file, calculated with Vincenty's formula
43	Travel speed	43.2	decimal	12.3	kilometres per hour [km/h]	calculated from distance and time between two subsequent GPS positions

Tips, Tricks & FAQ

How to read the plots

At the top of the plot window horizontal strip of points reflects how and when the GPS positions have been collected, time spent in the range of the base station, working hours, work of the light sensor, which GPS positions have been missed while the animal was diving or when it was in den or burrow where GPS signal was not present.

The battery voltage is also an important parameter to decide for example about changing the GPS interval into longer to avoid deep battery discharging and as a result recording irregularly collected and fragmented data.

This plot shows very well charged battery; in such case it is possible set shorter GPS interval to collect more positions:
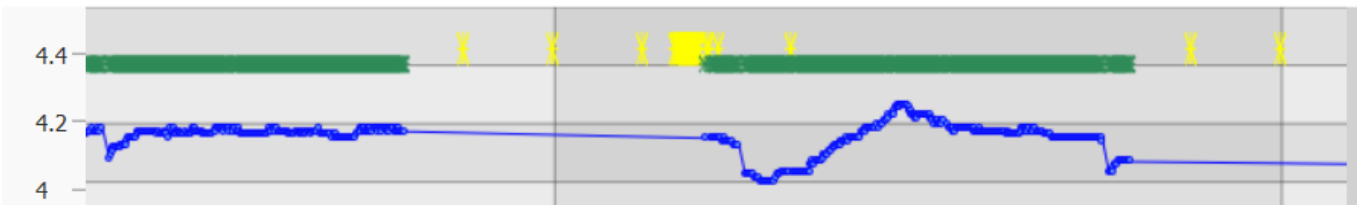
How to erase data cache

When you fell, that huge data files affect your PC efficiency, or the disk space is limited, it is possible to erase downloaded raw data from the web panel.

Web data erase – when all data downloaded from the web panel have been already processed and saved in csv files, you may consider erasing of huge data files, stored in your Web data folder. It is the folder chosen from Web access menu:
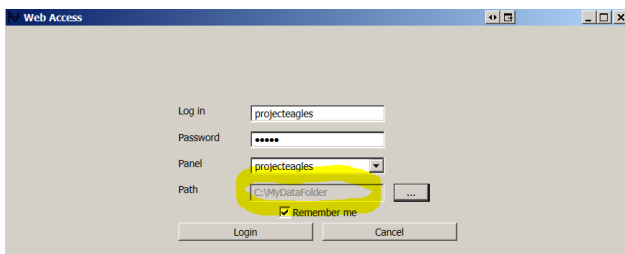
This folder will be created automatically again, when you will preview maps or use synchronize or download functions from the Web Access/Download menu.

Activity report (activity index)

- **Activity report 480** - reflects precise activity pattern with 480 points resolution/day for each axis. It comes together with data downloaded by the UHF to the base station or via GPRS/3G to our server. They are not available by SMS transmission. The data files of this report are still much much smaller, than the raw acceleration data recorded in bursts and - in contrast to raw acceleration data - cover the whole day with

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no gaps. The "480 report" reflects well activity pattern, allows distinguish many types of behaviour, especially when it is in prior calibrated with raw acceleration data and/or with observations of animal's behaviour.

This kind of report is recommended, when the raw acceleration data cannot be recorded or downloaded, due to their huge capacity during the long periods with no access to GSM network or when UHF download is not possible. In many cases processing billions of lines of raw acceleration data are very difficult and time consuming, therefore the activity index might be an alternative in many projects.

How to read this report: The acceleration sensor is checked every 4 seconds for each axis separately, when the readings after four seconds are higher than 10% of previous value, system records "move" and adds 1 to the counter. Every 3 minutes values are written to the memory as a record for each axis separately.

We suggest to activate this function and use it all the time. The power consumption for its work is minimal and data do not use so much memory. Due to 4 seconds sampling rate and creating the activity index every 3 minutes, almost all intense moves of the animal will be recorded, in contrast to raw acceleration data, which are recorded in much longer intervals and with bursts, which cover relatively short periods of time.

Example:

The graphs below show one day of activity data of the same vulture individual, recorded simultaneously by two different methods.

For example, between 9:30 and 11:30 the vertical Z axis shows the highest values and it represents flight activity.

- Activity report 480 (480 points/day x 3 axis)
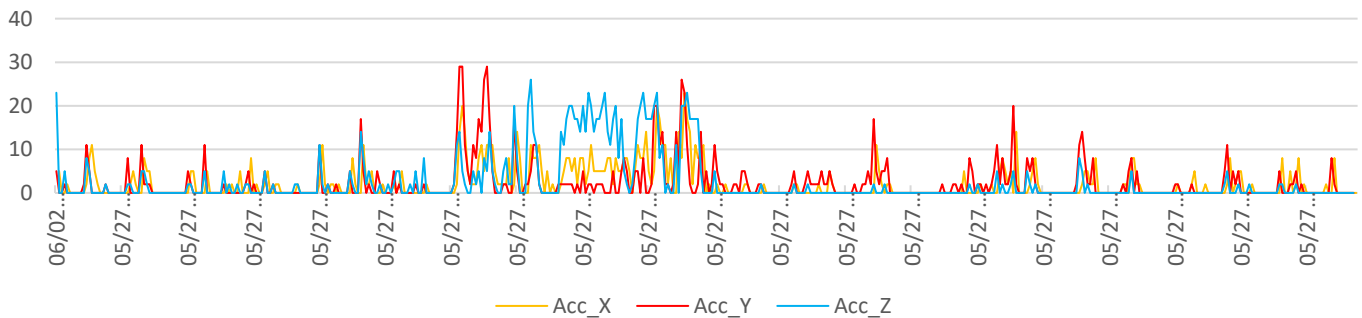
- Acceleration raw data in bursts

Activation from Web panel: **Activation from the Tracker:**

Acceleration raw data

Acceleration raw data recorded in bursts – parameters of each burst are user adjustable, sampling rate from 1 to 30 Hz and numb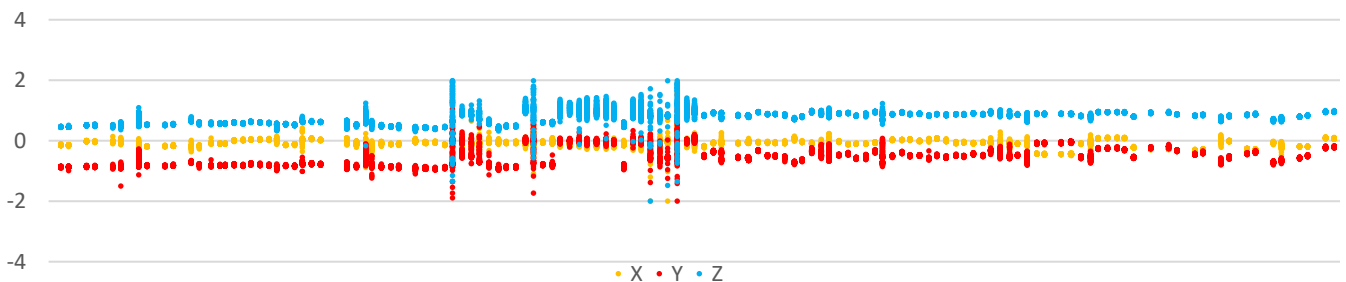er of recorded samples in one series from 4 to 128. Interval between burst can be adjusted in range from 5 to 240 minutes, additionally, each GPS position initiates acceleration data recording. When the duty are selected, outside the duty hours (idle time) the bursts will be recorded in preselected intervals e.g. every 30 minutes. Within the working hours (duty time) bursts will be collected simultaneously with each GPS position. The optimal settings are when the GPS interval is shorter than bursts interval – as a result in duty hours will be recorded more frequently and during the idle time, less frequently.

When the DAY or NIGHT function is selected, bursts will be collected within GPS interval, even the GPS positions will be not recorded to save energy.

Capacity of the memory is big, nevertheless has some limitations for raw accelerometer data:

- When logger has no active FTP download (GPRS/3G) and uses only UHF download from the base station, the maximal acceleration data limit is 80.000 samples (lines) which is pretty enough for a few days of very intense data collection. Due to relatively slow UHF data transfer speed, bigger files cannot be transferred with no risk of battery discharging. Please use this function only when bird regularly visits the base station range (e.g. breeding bird and the base station works near the nest) and acceleration data can be downloaded in not so big portions.

- When data download to FTP is active, logger can record in the memory 4.000.000 accelerometer samples (timestamp + 3 axis acceleration). Each data download releases the memory and new data can be recorded.

Example:
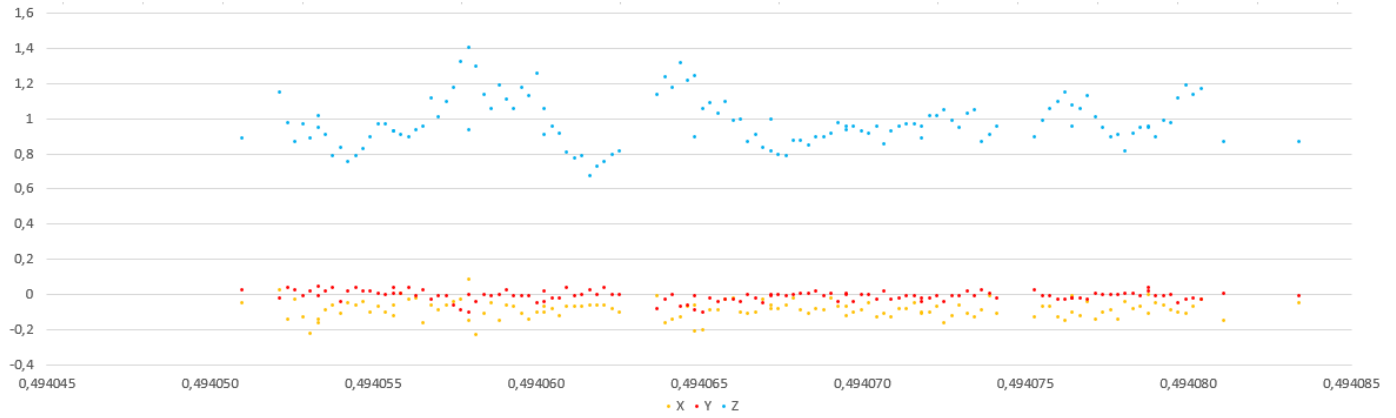
Activation from Web panel:

ACCELEROMETER SETTINGS [CHANGE ▼]

| 5min ▼ | 5 ▼ | 128 ▼ |
| INTERVAL [minutes] | SAMPLING [Hz] | N SAMPLES |

Activation from the Tracker:

| CREX BASE MODE | SENSORS SETTINGS |
| GROUP MODE | DROP OFF ACTIVATION |

TDR diving data

Loggers equipped with a TDR sensor can record diving profiles (depth) and water temperature. The sampling interval is user programmable in the range of 1-5s. TDR data is only recorded when the logger is underwater. The depth is calculated automatically from the pressure readings and the sensor is calibrated after each ascent.

Sensor parameters: Hydrostatic pressure 0-30 bar or 0-50 bar (~300 -500 m depth), resolution 2.5 mbar (2.6 cm), absolute value accuracy 50 mbar.

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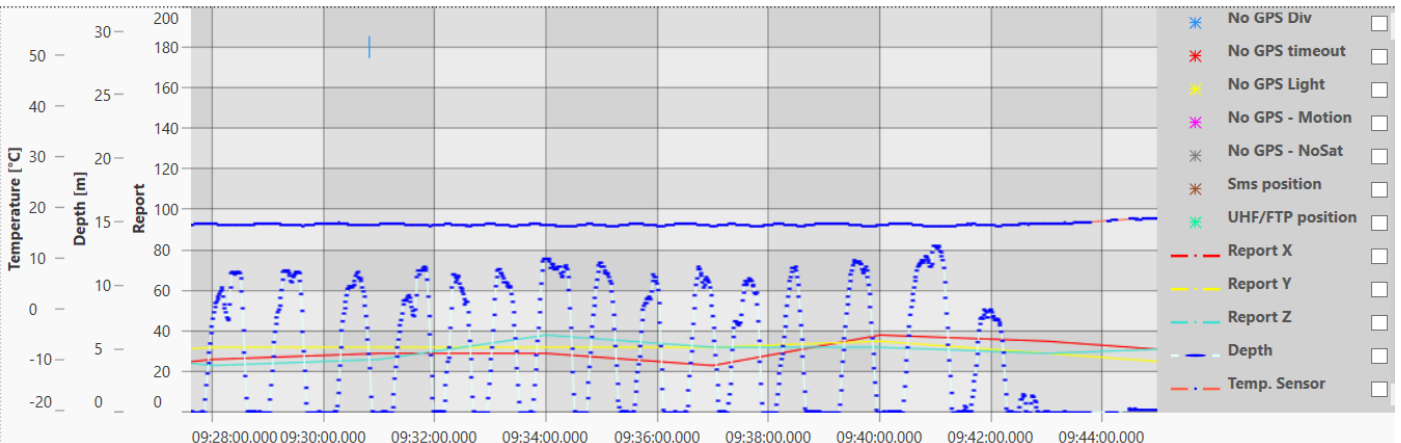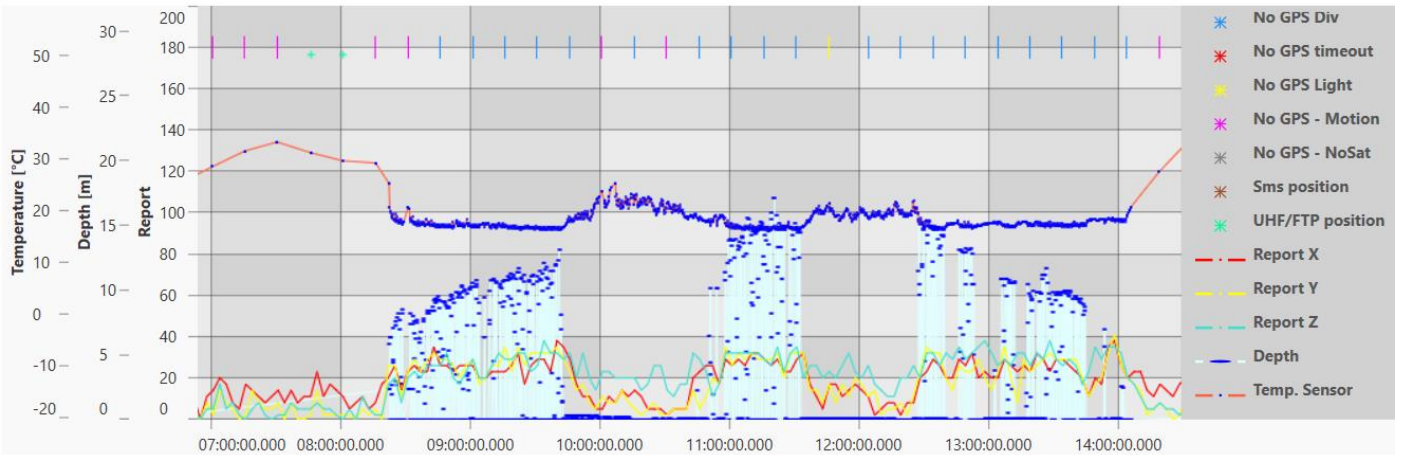
Troubleshooting

Read the manual to be sure that you use all functions properly.

Check periodically if updated manual is available.

The manual can be downloaded from: http://telemetry.ecotone.pl/public/NGAnalyzer/.

In case of any problems with the NGA software, send us the NGA.log, it is necessary to recognize and fix them:

   Press the Windows + R, it will open the "RUN" box where you can type commands.

Copy: *"%AppData%/NGanalyzer"*, paste it into the command box and press enter to open the NGA parental folder.
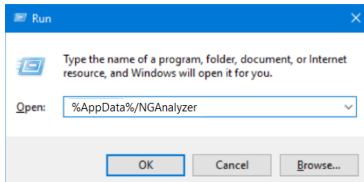
Copy the file NGA.log and send to us with short description of the problem.

When you would like to discuss with us your data or ask questions about graphs or logger functioning, send the raw data files and screenshots of the NGA graphs.

Before sending screenshots, go to "User Settings" menu, save your favourite settings by "Save as" and restore NGA graphs style to factory settings by "Factory Reset".

It will be much easier to compare graphs generated by you and by us when the same colours and styles will be used.